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THE VIRGINIA JOURNAL OF SCIENCE

A JOURNAL ISSUED QUARTERLY BY THE

VIRGINIA ACADEMY OF SCIENCE

PROCEEDINGS FOR THE YEAR

1955 — 1956

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CONTENTS

Pages

Proceedings for the Year 1955-56

Minutes of the Thirty-Fourth Annual Meeting, May 9, 10, 11, 12, 1956

Detailed Table of Contents 174

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VOL. 7, NEW SERIES No. 4

VIRGINIA ACADEMY OF SCIENCE

Proceedings for the Year 1955 – 1956

MINUTES OF THE THIRTY-FOURTH ANNUAL MEETING

MAY 9, 10, 11, 12, 1956

AT JEFFERSON HOTEL

RICHMOND, VIRGINIA

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D. Maurice Allan	1937-38
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George W. Jeffers	1941-42
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*W. Catesby Jones	1943-44
Robert F. Smart	1944-45
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Arthur Bevan	1946-47
Jesse W. Beams	1947-48
Sidney S. Negus	1948-49
Boyd Harshbarger	1949-50
Guy W. Horsley	1950-51
Paul M. Patterson	1951-52
Lloyd C. Bird	1952-53
Allan T. Gwathmey	1953-54
Irving G. Foster	1954-55
Walter S. Flory, Jr.	1955-56
Edward S. Harlow	1956-57

*Deceased.

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Melvin A. Pittman (William and Mary), Meeting Rooms and Equipment
William G. Guy (William and Mary), Public Information
Roger Dudley (William and Mary), Public Information
Mrs. Margaret C. Phillips (Norfolk Division of William and Mary), Registration

Contents

LIST OF PRESIDENTS 206
OFFICERS AND COMMITTEES FOR 1955-56 207
OFFICERS AND COMMITTEES FOR 1956-57 208
JEFFERSON MEDAL WINNERS 213
HORSLEY AWARD 213
GENERAL PROGRAM — THIRTY-FOURTH ANNUAL MEETING 215
TABULATION OF REGISTRATION 217
MINUTES OF COUNCIL MEETING 218
MINUTES OF ACADEMY CONFERENCE 222
MINUTES OF ACADEMY MEETING 224
MINUTES OF COUNCIL MEETING 225
REPORTS OF
Secretary-Treasurer 228
Committees
Long Range Planning 231
Research 232
Finance 233
Resolutions 233
Junior Academy of Science 235
James River Project 240
Conservation 240
Virginia Flora 241
Virginia Institute for Scientific Research 242
Science Education 243
Awards 244
Virginia Journal of Science 245
Jamestown Exposition 248
Academy Income 249
Membership 250
MINUTES OF SECTIONS
Agricultural Sciences 251
Astronomy, Mathematics, and Physics 261
Bacteriology 280
Biology 284
Chemistry 295
Education 311
Engineering 315
Geology 322
Medical Sciences 331
Psychology 344
Science Teachers 352
Statistics 355
LIST OF MEMBERS 363
MEMBERSHIP APPLICATION 389
FORM OF BEQUEST 389

JEFFERSON MEDAL WINNERS

RECIPIENTS OF THE JEFFERSON GOLD MEDAL[1]

Alfred Chanutin	1936
William B. Porter	1937
H. M. Phillips	1938
G. M. Shear and H. D. Ussery	1939

RECIPIENTS OF THE JEFFERSON PRIZE[2]

L. G. Overholzer and John H. Yoe	1940
Allan T. Gwathmey	1941
R. N. Jefferson	1942
W. H. Hough	1943
Clinton B. Cosby	1944

RECIPIENTS OF J. SHELTON HORSLEY RESEARCH AWARDS

Carl C. Speidel	1927
John H. Yoe	1928
J. C. Street	1929
H. E. Jordan	—
Carl C. Speidel	1930
E. C. Stevenson	1931
James H. Smith	1932
S. A. Wingard	1933
E. P. Johnson	1934
Margaret Hess	1935
Alfred Chanutin	1936
R. G. Henderson	1937
S. G. Bedell	1938
M. J. Murray	—
F. F. Cleveland	1939
Walton C. Gregory	1940
Charles Ray	1941
No Award	1942
J. B. Meyer	1943
J. H. Taylor	1944
No Award	1945
Boyd Harshbarger and D. B. DeLury (separate papers)	1946

[1] The winning papers in this competition were entered against those of the North Carolina, South Carolina, Georgia, and Florida Academies of Science. It was discontinued in 1940.

[2] The winning authors had the choice of the Jefferson Prize or the Academy Prize during this period. The name of the Academy Prize was changed to the J. Shelton Horsley Award and the Jefferson Prize discontinued in 1944.

No Award	1947
Henry Leidheiser, Jr.	1948
Walter S. Flory, Jr.	1949
Erling S. Hegre	1950
David B. Duncan	1951
D. R. H. Gourley	1952
Stephen Berko	—
Frank L. Hereford	1953
Lynn D. Abbott, Jr. and Mary J. Dodson	1954
Albert W. Lutz	1955
M. C. K. Tweedie	1956

General Program of The Thirty-Fourth Annual Meeting 1956

All meetings, unless otherwise indicated, will be held at the Hotel Jefferson, Richmond, Virginia

WEDNESDAY, MAY 9

5:00 P.M. to 10:00 P.M.—Registration for Junior Academy Members and Participants in the Science Talent Search. Main Lobby.

5:00 P.M. to 10:00 P.M.—Arrangement of Exhibits. Jefferson Court.

THURSDAY, MAY 10

8:00 A.M. to 10:00 P.M.—Registration. Main Lobby.

9:00 A.M.—Meeting of Science Exhibit Judges. Randolph Room. Meeting of Science Talent Search Judges. Virginia Room.

9:30 A.M.—Meeting of Chairmen, Exhibitors, and Science Talent Search Participants. Monticello Room.

10:00 A.M. to 12:30 P.M. and 1:30 to 4:00 P.M.—Finalists of Talent Search Meet with Chairmen and Interviewers. Monticello Room, Randolph Room, Virginia Room, and Library.

10:00 A.M. to 12:30 P. M. and 1:30 to 4:00 P. M.—Judging of Science Exhibit Contest. (Encouragement of Juniors at their Exhibits.) Jefferson Court.

2:00 P.M.—Meeting of the Council. Randolph Room.

4:00 P.M.—Meeting of Section Officers. Monticello Room. Meeting of Junior Academy of Science Committee. Virginia Room.

4:30 P.M.—Meeting of Section Editors. Randolph Room.

8:00 P.M.—Virginia Junior Academy of Science Assembly. National Geographic Society Lecture. John Marshall High School Auditorium, 8th and Marshall Streets.

9:15 P.M. to 9:50 P.M.—*Annual Academy Conference.* John Marshall High School Auditorium.

FRIDAY, MAY 11

8:30 A.M. to 10:00 P.M.—Registration. Main Lobby.

9:00 A.M. to 11:00 A.M.—Coffee Hour for Visiting Ladies with Hat Show by Sara Sue of Miller & Rhoads. Lobby.

9:00 A.M.—Section Meetings. See the detailed section programs for the time schedule of papers.

Agricultural Sciences—Empire Room "A".

Astronomy, Mathematics, and Physics—Flemish Room.

Bacteriology—Monticello Room.

Biology—Empire Room "B".

Chemistry—Library "A" and "B".

Education—Second Baptist Church House, 7 East Franklin Street, Room 11.

Engineering—Virginia Room.

Geology—Y. M. C. A., 2 East Franklin Street, Game Room.

Medical Sciences—Washington Room.

Psychology—Second Baptist Church House, 7 East Franklin Street, Little Theatre.

Science Teachers—Ballroom.

Statistics—Second Baptist Church House, 7 East Franklin Street, Room 10.

12:00 Noon to 1:00 P.M.—Virginia Junior Academy of Science Assembly. (See Program of Junior Academy.)

1:00 P.M. to 2:00 P.M.—Recess for Luncheon.

2:00 P.M.—Section Meetings.

3:30 P.M. to 5:00 P.M.—Reception for Visiting Ladies. Glasgow House, 1 West Main Street.

5:00 P.M. to 7:45 P.M.—Recess for Dinner.

7:45 P.M.—Virginia Academy of Science Assembly. Ballroom. Short Business Meeting. Election of Officers.

Presentation of Distinguished Service Awards.

Presentation of the J. Shelton Horsley Research Award.

Guest Speaker: Dr. Edgar Anderson, Director, Missouri Botanical Garden, St. Louis.

Subject: "How to Measure a Species Difference and Why Bother."

The general public is invited to attend.

SATURDAY, MAY 12

9:00 A.M.—Section Meetings.

9:30 A.M.—Meeting of the Advisory Panel on Education in the Sciences, Virginia Academy of Science. Ballroom. All interested in science education in Virginia are invited to attend and take part in the discussion.

10:00 A.M.—Meeting of the Council of the Academy. Randolph Room.

Tabulation of Registration

Section	*Members*	*Non-Members*	*Total*
1. Agricultural Sciences	22	9	31
2. Astronomy, Mathematics & Physics	33	29	62
3. Bacteriology	14	5	19
4. Biology	77	18	95
5. Chemistry	82	40	122
6. Education	3	1	4
7. Engineering	9	8	17
8. Geology	20	7	27
9. Medical Sciences	32	18	50
10. Psychology	24	4	28
11. Science Teachers	20	14	34
12. Statistics	13	12	25
No Section Preference	31	41	72
Total	380	206	586

Total Registration of the Junior Academy	166
Total Registration 1956 Meeting	752

MINUTES OF THE MEETING OF THE COUNCIL, RICHMOND, MAY 10, 1956

A meeting of the Council of the Virginia Academy of Science was held in the Randolph Room of the Jefferson Hotel, Richmond, at 2:00 P. M., May 10. President Walter S. Flory presided with the following members present: Byron C. Cooper, Irving S. Foster, Allan T. Gwathmey, Edward S. Harlow, Mrs. B. F. Heatwole, William M. Hinton, Horton H. Hobbs, Jr., Sidney S. Negus, B. F. D. Runk, William B. Wartman, Jr., Stanley B. Williams, and Foley F. Smith. Minutes of the last meeting were read and approved.

Suggested changes and revisions in the Constitution and By-laws were read by Sidney S. Negus and were discussed. Previous changes were noted that had not received approval of the Academy Conference. These were listed for action by the Conference Thursday evening. Additional changes proposed and passed at the Council meeting were (1) that the Chairman of the Research Committee be made an appointed member of the Council and (2) that all appointed members of the Council, which include the Chairman of the Long Range Planning Committee, Chairman of the Research Committee, Editor of the Virginia Journal of Science, and Managing Editor of the Virginia Journal of Science, should serve with voice but no vote. Additional minor changes, particularly with respect to phraseology in the Constitution and By-Laws, were approved by the Council and were also to be acted upon by the Academy Conference Thursday evening, May 10, 1956.

All Conference-approved changes will be published in the Virginia Journal of Science. The revised Constitution and By-Laws will be mimeographed and sent to all Academy officers, members of the Council, committee chairmen, and Section officers. Assistant Secretary-Treasurer, W. B. Wartman, Jr., was officially commended for his excellent work in collating all the changes in the Constitution and By-Laws since their adoption in 1950.

The resignation of Horton H. Hobbs, Jr., and B. F. D. Runk as Editor and Managing Editor, respectively, of the Virginia Journal of Science were offered to the Council and regretfully accepted. Both resignations were offered due to the pressure of other duties. However, each agreed to continue in office until successors were obtained, or until January 1, 1957. Dr. Hobbs also indicated that he would remain in office for the publication of the special Jamestown Celebration issue of the Journal.

Dr. Hobbs read the Editor's report and emphasized the need for more and diversified scientific papers, since the backlog of papers to be published was now at a minimum. He requested all members of the Council and others to emphasize in their respective Sections the use of

the Journal as a vehicle for publication of scientific papers. Dr. B. F. D. Runk reported on the financial status of the Journal and both reports were accepted on proper motion. Some discussion regarding the negotiations for a new printing contract ensued and the hope was expressed that their present contract would be renewed.

It was decided that the special Jamestown Exposition issue of the Journal would be reprinted from the regular January 1957 issue, that 1200 copies of the January 1957 issue would be printed, including advertising as usual, and that 5000 reprints of this issue would be published with suitable binding, which would carry no advertising and which would be sold at a nominal price at the Jamestown Celebration.

The Council went on record in commendation of Dr. Hobbs and Dr. Runk and it was further moved, seconded and passed that appropriate resolutions commending their acivities be presented at the Friday evening meeting of he Academy.

Irving G. Foster, Chairman of the special committee to study Academy finance, read his committee's report, the text of which follows:

"This committee was appointed by President Flory to investigate sources of revenue available to the Academy. Since the amount of income should depend upon the Academy's needs, this committee considered possible future expenditures. The normal growth in membership makes it appear probable that a considerable increase in the cost of maintaining the Secretary's office will occur, and should be anticipated. Junior Academy work has increased greatly in the last few years, and this has been accompanied by large increases in the funds allotted to the Junior Academy Committee. It should be noted, however, that much of this money has been given to the Academy for this particular purpose.

"If no *immediate* large increase in expenditures for either of the items above (or others not foreseen by this committee) is contemplated, then there is no need for any special effort to raise additional revenue at the present time. This committee is not aware of any year recently in which the Academy operated with a deficit, hence present income seems to cover present needs.

"The committee nevertheless considered means of increasing Academy income, and believes there are but three feasible methods. In order of importance they are (1) increasing the number of business members, (2) increasing the number of sustaining and contributing members, and (3) raising dues. In addition, the registration fee for the annual meeting might be raised.

"(1) The largest potential for increased income lies in an increase in business memberships. A concerted and organized campaign to obtain such memberships should bring in a good return, judging by the past

experience of the Finance Committee. If a large increase in income is desired the committee recommends such an effort.

"(2) A real effort to increase the number of sustaining and contributing members might be made. This could conceivably increase our income by $1,000. We recommend that this be tried.

"(3) The committee is sharply divided over the desirability of raising dues. No increase of more than $2,000 could possibly be netted in this way, if dues were raised to $5.00. This step is not recommended.

"Considering the present financial situation, this committee feels no sense of urgency in embarking upon any of the three steps mentioned above."

At the April 14 meeting of the Finance Committee, Walter Flory presented a suggested new and simplified, but still essentially complete, form for presenting the Academy Financial Statement in the annual Proceedings. This suggested form was provided through the generosity of Carman G. Blough, Director of Research, American Institute of Accountants, New York City. Following April 14, correspondence and forms were mimeographed and submitted to all Finance Committee and Council members for consideration. On recommendation of the Finance Committee the Council voted approval of the use of the suggested form in presenting subsequent Financial Reports in the Proceedings. This form distinguishes between (1) revenue receipts, (2) disbursements from revenue, (3) receipts of principal, (4) disbursements from principal, (5) transfers to other funds, and (6) transfers from other funds. The Council voted that its sincere thanks be extended to Mr. Blough.

The Council also accepted the recommendation of the Finance Committee that the budget of the Academy be prepared by the Finance Committee in the fall for the Council's approval at its fall meeting. Thus, it would represent a true budget rather than an estimation of commitments, a portion of which already having been expended.

The Council duly authorized the appointment of three trustees whose responsibility it would be to determine the disposition of the investments of the Academy and relieve the President and Secretary-Treasurer of this duty. The following trustees were appointed by the Council for one, two and three year terms, respectively: Charles T. O'Neill, H. R. Hanmer and Lloyd C. Bird. Subsequently, one trustee will be appointed each year to replace the one whose term has expired. Lloyd C. Bird will serve as Chairman of the trustees and after his term expires, the senior trustee, in point of service, will serve as Chairman. The trustees are to report to the President and Secretary-Treasurer semiannually, and at such other times as might be required, regarding the status of the Academy's investments.

Due to the incompatibility of the Constitution and By-Laws of the

Psychology group with that of the Virginia Academy, Dr. Stanley R. Williams and Dr. William M. Hinton reported that the psychologists were planning a business meeting Friday night at which time a separate association, composed entirely of psychologists, would probably be organized. They indicated that many, if not the greater proportion of the members of the Psychology Section, would continue to be affiliated with that Section of the Academy, and expressed the hope that they might meet as always with the Academy. Their own business meeting would be held separately but at the same time and at the same location. Dr. Williams stated that he would attend the Council meeting Saturday, May 12, to report on the action taken.

There being no further business, the meeting adjourned at 4:25 P. M.

FOLEY F. SMITH, *Secretary-Treasurer*

MINUTES OF THE ACADEMY CONFERENCE, RICHMOND, MAY 11, 1956

The meeting was called to order in the ballroom of the Jefferson Hotel by President Walter S. Flory, Jr., at 8:05 P. M. President Flory introduced Dr. William T. Sanger, President of the Medical College of Virginia, who very graciously welcomed the members of the Academy to Richmond for the Thirty-Fourth Annual Meeting.

President Flory then recognized Dr. Raymond L. Taylor, Assistant Executive Secretary of the American Association for the Advancement of Science. Dr. Taylor extended greetings from the AAAS to the Academy, and spoke graciously of the value of the Virginia Academy of Science among the other forty-two State Academies, and also of its place of leadership in the Academy Conference held at the annual AAAS meeting. Dr. Taylor stated that the program for the New York meeting of the AAAS December 26-31, 1956, would appear in the May 25 issue of "Science".

Paul M. Patterson, Chairman of the Resolutions Committee, spoke for the committee, and it was moved, seconded, and passed, that the resolutions be accepted for publication in the Proceedings.

Edward S. Harlow, substituting for Stanley B. Williams, reported for the Place of Meeting Committee, and it was unanimously voted to accept the offer of the College of William and Mary to serve as host to the Academy at the Chamberlin Hotel, Old Point Comfort, May 9, 10, 11, 1957.

Allan Gwathmey reported for the Nominating Committee, and proposed the following slate, which was unanimously elected for the coming year:

President Edward S. Harlow, Assistant Laboratory Manager, American Tobacco Company Research Laboratory, Richmond.

President-Elect William G. Guy, Chairman of the Department of Chemistry, College of William and Mary, Williamsburg.

Secretary-Treasurer Foley F. Smith, Virginia Alcoholic Beverage Control Board, Richmond.

Assistant Secretary William R. Wartman, Jr., American Tobacco Company Research Laboratory, Richmond.

Member of Council (term five years) Thomas E. Gilmer, Professor of Physics, Hampden-Sydney College, Hampden-Sydney.

The first Distinguished Service Awards made in the history of the Academy were presented by Boyd Harshbarger, as Chairman of the Awards Committee. Dr. Harshbarger called on George Jeffers to present

the Distinguished Service Award to Dr. Ivey F. Lewis, Dean of the University of Virginia, who served as the first President of the Virginia Academy of Science. Dr. Lewis' citation was as follows: "Able investigator; master teacher, who with gentleness of manner, with kindness and understanding, has labored for the advancement of science and the welfare of mankind."

After Dr. Lewis' acceptance, with remarks of appreciation, Dr. Harshbarger presented the Distinguished Service Award to Dr. William T. Sanger, President of the Medical College of Virginia. Dr. Sanger also served as President of the Academy in 1934-1935. Dr. Sanger's citation was as follows: "National leader, builder of the Medical College of Virginia, superior organizer, and administrator of programs for better health."

Chalmers L. Gemmill reported for the Research Committee, and announced that Dr. M. C. Kenneth Tweedie, Statistical Laboratory, Virginia Polytechnic Institute, was awarded the J. Shelton Horsley Award for his paper "Statistical Properties of Inverse Gaussian Distributions," presented before the Section of Statistics. Dr. Tweedie gave a short resume of his report.

William G. Pettus, of the University of Virginia, was presented the J. Shelton Horsley Honorable Mention Award, for his paper on the "Production and Scattering of Polarized Electrons," presented before the Section of Astronomy, Mathematics, and Physics.

The Teachers Scholarship Awards were made to Allan Mandell, Craddock High School, Norfolk County, Virginia; and Frances Hurt, of Andrew Lewis High School, Salem, Virginia. James Mays, of Newport News High School, Newport News; and Virginia Ellett, of Thomas Jefferson High School, Richmond, were named as alternates.

The business session adjourned, and the guest speaker of the evening, Dr. Edgar Anderson, Director of the Missouri Botanical Gardens, was introduced by President Flory, and gave an interesting address on "How to Measure a Species Difference and Why Bother", after which the meeting adjourned.

FOLEY F. SMITH, *Secretary*.

MINUTES OF THE ACADEMY MEETING, MAY 10, 1956

The Academy Conference was held in the auditorium of the John Marshall High School, Richmond, May 10, 1956, following the final meeting of the Junior Academy of Science. A quorum of more than forty members being present, the meeting was called to order at 9:45 P. M. by President Flory.

On proper motion the reading of the minutes of the last Academy Conference was dispensed with, as they were published in the Virginia Journal of Science.

Following the report of the Secretary-Treasurer, the various standing committees reported, and these reports follow as a part of the Proceedings of the Annual meeting for 1956.

Following the reports of the committees, the adoption of the changes in the Constitution and By-Laws of the Academy as recommended by the Council was moved, seconded, and passed. The revised Constitution and By-Laws will be mimeographed and sent to all officers, members of the Council, and all Section officers.

Allan Gwathmey commented on various phases of the Academy Conference and proposed that increased effectiveness of the Conference might be achieved if it could be started earlier in the evening, allowing more time for detailed discussion of the various Committee reports. This suggestion was recommended to the Council for consideration at their Saturday meeting.

FOLEY F. SMITH, *Secretary.*

MINUTES OF THE COUNCIL MEETING MAY 12, 1956

The meeting of the Council of the Virginia Academy of Science was held in the Randolph Room of the Jefferson Hotel, Richmond, and was called to order by President Edward S. Harlow at 10:00 A. M.

Present were: Irving C. Foster, Walter S. Flory, Jr., T. E. Gilmer, Allan T. Gwathmey, Mrs. B. G. Heatwole, Horton H. Hobbs, Jr., Sidney S. Negus, B. F. D. Runk, William B. Wartman, Jr., Stanley B. Williams, and Foley F. Smith.

The minutes of the last meeting were read and approved.

1. *Scheduling of the Academy Conference at the Annual Meeting*—Allan Gwathmey expressed the feeling that participation by the membership in discussions of Academy affairs was a desirable feature of the Annual Academy Conference. The scheduling of the Conference after the Junior Academy activities, as has been the practice in recent years, has resulted in the Conference being held at a rather late hour. This, he felt, was not conducive to participation by the members in discussions of Academy activities. He inquired concerning the feasibility of scheduling the Academy Conference at a different hour at future meetings.

The Council was in agreement with his feelings in the matter and, after considerable discussion, it was moved and passed that the president appoint a committee to study the possible scheduling of the Conference at a more appropriate time in order to encourage discussion by the members of the Conference.

2. *The Possibility and Desirability of Acquiring Seashore State Park by the Academy.*—As a result of earlier discussions in the Long Range Planning Committee meeting, the question arose as to the feasibility and desirability of acquiring Seashore State Park by the Academy as a wilderness preserve for scientific study and/or where the Academy might provide a place for scientific instructional programs for science teachers and others. This latter arose from a suggestion of Dr. Bruce D. Reynolds and others. It was pointed out that financial obstacles would, in all probability, rule out this possibility. Other difficulties were mentioned even if financial obstacles should prove surmountable. It was moved and passed that this matter be referred to the Long Range Planning Committee, who were to set up a subcommittee to study these proposals.

3. *Application to the National Science Foundation for a Grant to Study the Results of the Virginia Science Talent Search.*—It was moved and passed that the Academy apply to the National Science Foundation for a $2500 grant to be used in a study of the results of the Virginia Science Talent Search. Mrs. B. G. Heatwole volunteered to conduct

such a survey should the funds become available, and she was requested to prepare the necessary application forms to be submitted to the National Science Foundation by the Academy.

4. *The Role of the Academy in Aiding Science Students to Secure Scholarships.*—It was felt that the Academy might play a more active part in aiding science students to secure academic scholarships. Accordingly, it was moved and passed that the president appoint a committee to function throughout the year in aiding science students to secure available academic scholarships.

5. *Qualifications for Honorary Life Membership.*—The Awards Committee recommended that specific qualifications be established for honorary life membership in the Academy. The Academy concurred in the recommendation and it was moved and passed that the present Awards Committee be requested to draw up proposed qualifications for honorary life membership in the Academy and present these at the next Council meeting.

6. *Teacher-Sponsor Scholarships.*—The Awards Committee was requested to select the recipients for the annual University of Virginia and William and Mary teacher scholarships. It was recognized that the recommendations of the Junior Academy Committee would be almost tantamount to selection.

7. *Secondary Science and Mathematics in the Secondary Schools of Virginia*—On Saturday morning, May 12, the Advisory Panel on Education in the Sciences of the Virginia Academy of Science recommended that the Council of the Academy take formal action regarding its feelings about science education, particularly in the secondary schools. Accordingly, the Academy Council passed the following resolution unanimously:

> "Being deeply concerned about the shortage of scientists and engineers and aware of its responsibility, the Virginia Academy of Science desires to cooperate fully with the State Department of Education. Therefore, be it resolved that a committee be appointed to represent the Virginia Academy of Science to work with the State Department of Education if and when requested, in strengthening the qualifications for high school science teachers, and in other ways to improve science and mathematics instruction in the public schools of Virginia."

The Council was advised by Stanley B. Williams that a group to be known as the Virginia Psychological Association had been formed, and would hold their annual business meeting at the same time and place as the Virginia Academy of Science.

It was suggested that a list of all new Section Officers be mimeographed, and sent to all officers and Council members together with the final revision of the Constitution and By-Laws.

It was suggested that the Section Officers be invited to attend a Council meeting sometime during each year.

The Council formally commended Walter S. Flory, Jr., for his services to the Academy as President for the past year, and also the outgoing Councillor, Stanley B. Williams, and recommended that formal recognition be made a part of the Minutes of this meeting.

There being no further business, the meeting adjourned at 12:00 P. M.

FOLEY F. SMITH, *Secretary.*

REPORT OF THE SECRETARY-TREASURER

The Thirty-Fourth Meeting of the Virginia Academy of Science appears to be the largest in the history of the Academy. The Junior Academy has already presented exhibits, both individually and as class exhibits that are outstanding, and in general are the best presented so far at any Junior Academy meeting.

The audit and report of the Finance Committee as well as the reports of the other committees, follow. Due to the efforts of President Flory in securing suggestions for simplifying and consolidating the usual detailed audit, this form will be used for the first time in the Proceedings of this meeting. The Finance Committee at its meeting decided that, in lieu of a budget being presented for 1955 at this meeting, the Treasurer's report to date would be substituted, since expenditures for some items have already been made for 1956. The committee decided that hereafter they would hold a late fall meeting to prepare a budget for the coming year, and present it to the spring Council meeting for consideration.

American Association of Advancement of Science Meeting.—Your Secretary represented the Academy at two Council meetings of the AAAS at Atlanta, Georgia, on December 27 and 30, 1955. The Council elected Lawrence H. Snyder as President-Elect; Paul M. Gross, of Duke University, as Vice-President; and George R. Harrison, Dean of Science, Massachusetts Institute of Technology, to the Board of Directors.

Changes in the Constitution and By-Laws of the AAAS recommended by the Committee, and endorsed by the Board of Directors, were approved by the Council.

The final report of this committee was published in "Science," November 25, 1955, and in "The Scientific Monthly," December 1955. The revised Constitution and By-Laws appear on pages 263-266 of "Science", February 17, 1956.

A member of the Academy, Bruce D. Reynolds, University of Virginia, was a member of the Council Committee on Resolutions. Others serving on the committee wih him were Harold H. Plough, Detlev W. Bronk, and Jane M. Oppenheimer.

In view of the many different points of view concerning conditions existing in Atlanta directly connected with such a meeting as the AAAS, several resolutions and statements of objection for future meetings, under such conditions, were received by the Committee. The Committee on Resolutions considered the various resolutions that had been submitted and prepared for Council's consideration the following resolution:

> The American Association for the Advancement of Science is a democratic association of all its members; no one is barred

from election because of race or creed. All members are privileged to cooperate freely in the fulfillment of the Association's high objectives which are the furtherance of science and human welfare. No member is limited in his service because of race or creed.

In order that the Association may attain its objectives, it is necessary and desirable that all members may freely meet for scientific discussions, the exchange of ideas, and the diffusion of established knowledge. This they must be able to do in formal meetings and in informal social gatherings. These objectives cannot be fulfilled if free association of the members is hindered by unnatural barriers. Therefore be it resolved that the annual meeting of the American Association for the Advancement of Science be held under conditions which make possible the satisfaction of those ideals and requirements.

After extensive debate over the effects and propriety of adopting such a resolution, and following the defeat of motions to table the resolution, the Council voted to submit the resolution by mail to the entire Council membership, and following the receipt of ballots on the resolution, the Council further voted to publish the resolution, and the vote if approved.

As reported in "Science," February 17, 1956, the resolution was adopted to a mail vote of 224 to 31, with 3 abstaining. The fact of its adoption was released to the press on January 23, 1956.

The Academy Conference.—The Academy was represented at the Academy Conference held at the Hotel Piedmont, Atlanta, December 25, 1955, by the Secretary and Thelma C. Heatwole, Secretary of the Conference last year. Thirty-one state and city Academies of Science were represented. The annual business meeting of the Academy was held at the morning session. President Leland Taylor (West Virginia) presided. Reports of the standing committee were made, and three minute reports were made by each official representative present on their respective Academies. John H. Behnke, AAAS Coordinator to the Conference, and Associate Administrative Secretary of the AAAS, was introduced and outlined the Science Teaching Improvement Program to be financed by a $300,000 grant from the Carnegie Foundation.

He also announced the decision of the Board of Directors concerning research funds that revert to the State Academies. They are to be specifically designated to be used for research grants at the secondary school level.

President-Elect P. H. Yancey (Alabama) assumed the office of President for 1956. Ralph L. Lefler (Indiana) was elected President-Elect. Thelma C. Heatwole was unanimously re-elected as Secretary. Panel

discussions were held at the afternoon session on "The Role of Academies of Science in AAAS Science Teaching Program" and "Science Fairs as an Academy Activity."

Sixty-two persons from Virginia were registered at the Atlanta meetings.

The Academy was officially represented at the White House Conference on Education in December 1955, by President-Elect Edward S. Harlow.

TREASURER'S REPORT FOR 1956

Already spent (June 1, 1956) or Estimated

Travel Expenses to Meeting	$ 150.00
Dues to Academy Conference	10.00
Major Catesby Jones Award	10.00
E. C. L. Miller Award	50.00
Junior Academy (Includes Philip Morris Grant of $750.00)	1,450.00
Science Talent Search	750.00
Annual Meeting Expense	400.00
Audit and Tax Service	215.00
Premium on Fidelity Bond	12.50
Post Office Box Rent	30.00
Stationery and Stenographic Service	450.00
Postage and Section Expense	135.00
Printing (1956 Leaflet)	325.00
Subscription to Journal for life and honorary members	36.00
Addressograph Service	50.00
Virginia Journal of Science	1,900.00
Miscellaneous and Contingencies	317.85
	$6,291.35

FOLEY F. SMITH, *Secretary-Treasurer.*

REPORT OF THE LONG RANGE PLANNING COMMITTEE

At a meeting of the Long Range Planning Committee on May 10, 1956, fifteen members, including the President, President-elect, and Secretary were present. Reports on the present status of work on several long term projects were received and discussed. In addition several items referred to the committee by the council were considerd and recommendations made.

A report by Dr. J. T. Baldwin, Jr., on the present status of the Dismal Swamp project was read by the chairman and discussed by the committee. The committee wishes to emphasize its continued interest in this important work, and wishes to urge those engaged in this project to expend special efforts toward the completion of the project, which was authorized and begun in 1952.

Dr. Marcellus Stow presented a report of the activities of his committee on the present status of plans for participation of the Academy in the Jamestown Exposition next year. Consideration discussion of the plans resulted, especially with regard to the special issue of the Journal which is contemplated. In view of more specific information on the nature of the Jamestown Exposition, and on the recommendation of his committee, it was voted by the Long Range Planning Committee to recommend to the council:

1) That the question of exhibits by the Virginia Academy of Science in the Jamestown Exposition be tabled and that it be understood at this point that we would not participate along these lines.

2) That appropriate action be taken to arrange financing of the special Jamestown Exposition Committee. Dr. Stow was commended by the committee for his excellent work on this project.

Dr. James Cole presented a report on the present status of the work of his committee on Science Education and included information on the "Symposium on Shortage of Science Teachers" and on the open meeting of his advisory panel to be held Saturday, May 12. A report will be made by him directly to the Academy and to the council. The committee expressed its appreciation to Dr. Cole for his great interest and excellent work with his committee and expressed its continued interest in following closely developments in the field of science education in which this committee is working.

With regard to the question of a survey of the results of Virginia Science Talent Searches, referred to the commitee by the council, the committee voted to endorse the plan proposd by Mrs. B. G. Heatwole, that the Academy apply to the National Science Foundation for a grant to make a study of the progress made by the Virginia Science Talent Search winners and honorable mentions.

With regard to the question of availability of scholarships in Virginia colleges for Science Talent Search winners it was voted to recommend to the council that a scholarship subcommittee to aid worthy young Virginia scientists to obtain scholarships and financial aid in Virginia colleges be set up in Dr. Cole's committee.

It was voted to recommend to the President that the Chairman of the Research Committee and the Editor of the Journal be appointed to the Long Range Planning Committee.

LYNN D. ABBOTT, JR., *Chairman.*

REPORT OF RESEARCH COMMITTEE

Grants.—During the period of May 15, 1955 to May 15, 1956, the following grants have been made:

R. H. Rageot. Study of animals of the Dismal Swamp. Curator of Natural History, Norfolk Museum, Norfolk 10, Virginia.	$200.00
B. R. Woodson, Jr. Continuation study of the Algal Survey of the James River Basin. Virginia State College, Petersburg, Virginia.	100.00
W. E. Old, Jr. Research on a survey of the Fauna of the Dismal Swamp area. 728 Raleigh Ave., Norfolk 7, Virginia.	100.00
G. W. Kent. Study of the pupillary response of the eye. Department of Psychology, Bridgewater College, Bridgewater, Virginia.	100.00
P. M. Patterson. Towards purchase of a phase microscope. Chairman, Department of Biology, Hollins College, Hollins, Virginia.	262.00
K. W. King. Purchase of desalting apparatus for laboratory. Department of Biology, Virginia Polytechnic Institute, Blacksburg, Virginia	150.00
B. J. Bogitsh. Collecting helminths of fish in fresh water ponds of Albemarle County, Virginia. Department of Biology, University of Virginia, Charlottesville, Virginia.	75.00
	$ 987.00
J. Shelton Horsley Research Prize for 1956	100.00
Honorable Mention for 1956	50.00
Total expenditures for May 15, 1955 to May 15, 1956	$1,137.00

CHALMERS L. GEMMILL, *Chairman.*

REPORT OF FINANCE COMMITTEE

The Finance Committee met April 14, 1956.

The auditor's report was reviewed and approved.

It was suggested and approved that in the future a consolidated and simplified form of reporting receipts and disbursements for publication in the Journal be prepared. It was proposed that in preparing a complete financial report that the statement distinguish between

(1) Revenue receipts.
(2) Disbursements from revenue.
(3) Receipts of principal.
(4) Disbursements from principal.
(5) Transfers to other funds.
(6) Transfers from other funds.

A budget based largely on the experience of the past was approved. The amount of the budget is $6,091.35, the two largest items being $1900.00 for the Journal and $1450.00 for Junior Academy activities.

It was noted that the 1956 budget includes expenditures made during the expired portion of the year (January, February, and March) and it was moved, seconded, and passed that in the future the Finance Committee should meet in the fall prior to the usual fall Council meeting, for the purpose of preparing an operating budget for the Academy's fiscal year beginning January 1.

The Committee directed that the budget attached be published in the Proceedings and be called "Treasurer's Report for 1956."

LLOYD C. BIRD, *Chairman.*

REPORT OF THE RESOLUTIONS COMMITTEE

BE IT RESOLVED that the Virginia Academy of Science extend its grateful appreciation to the tireless efforts of the following groups who made its thirty-fourth annual meeting a successful, profitable and enjoyable occasion.

1. To its host, The Richmond Area University Center Inc.
2. To Colonel Herbert W. K. Fitzroy and his Committee on Arrangements with special attention to Mr. Paul Heim, his active and able assistant.
3. To the management and staff of Hotel Jefferson of Richmond.

BE IT FURTHER RESOLVED that the Virginia Academy of Science hereby convey its appreciation ot Boyd Harshbarger, Editor of the New Series of the Virginia Journal of Science from its first number January

1950 to the second number of Volume 6 in April 1955 when he was compelled to resign from pressure of other duties; for his untiring, capable and efficient role in establishing with his competent staff a high caliber scientific journal, and for his sound and efficient financial management thereof.

BE IT FURTHER RESOLVED that the Virginia Academy of Science extend its grateful appreciation to Dr. Horton H. Hobbs, for his tireless and exacting work with the New Series of the Virginia Journal of Science since its inception in 1950, first as Technical Editor and later as Editor, and for his part in the maintenance of the high standards of this publication and to Dr. B. F. D. Runk for his recent and competent work as Managing Editor of this Journal.

BE IT FURTHER RESOLVED that the Virginia Academy of Science regretfully record its loss and pay its tribute to its esteemed members who have been claimed by death during the past two years.

PAUL M. PATTERSON, *Chairman.*

REPORT OF THE VIRGINIA JUNIOR ACADEMY OF SCIENCE COMMITTEE

JUNIOR OFFICERS

Adrienne Nettles, *President*
John Towler, *President-Elect*
Ardelia Brown, *Secretary*

COMMITTEE MEMBERS

Edward R. Dyer
Miss Susie V. Floyd
E. Sherman Grable
Miss Beatrice Harrington
J. C. Holmes
George D. Sands
Franklin D. Kizer
Reuben R. McDaniel
H. H. Garretson
Bruce D. Reynolds
D. L. Kinnear
H. Felix Sanders

Mrs. B. G. Heatwole, Chairman

COMMITTEE MEETINGS

June 11, 1955—Albemarle Hotel, Charlottesville
Nov. 19, 1955—Monticello Hotel, Charlottesville
March 31, 1956—Thomas Jefferson Inn, Charlottesville
May 10, 1956—Hotel Jefferson, Richmond

The Virginia Junior Academy of Science, organized to encourage and assist secondary school students who have an aptitude for science, had during 1955-56 an individual membership of 5322, representing 92 science clubs directly affiliated with it. Sixty more clubs were affiliated with the Junior Academy through affiliation with Science Clubs of America. The clubs represent both Junior and Senior High Schools from every region of the State.

The following activities have been carried out during the year:

Mimeographed letters concerning activities were mailed three times during the year to all public and private high schools in the State.

The *Junior Science Bulletin* was issued three times during the year and mailed to every science teacher in the State whose mailing address could be obtained. The publication of the *Bulletin* was made possible by a contribution of $200.00 by the American Tobacco Research Laboratory. The printing was done by the Newport News High School print shop under the direction of Miss Susie V. Floyd.

A traveling library of kodachrome slides showing science projects displayed at the 1953-54 meeting of VJAS was circulated among the clubs.

Grants were made, to assist in project work, from research funds made available to the Virginia Academy of Science by the American

Association for the Advancement of Science and by Philip Morris, Inc.

Summer scholarships of $200.00 each were again made available by the University of Virginia and the College of William and Mary as awards by two outstanding Teacher-Sponsors.

Five Junior Science Days were sponsored by five colleges in cooperation with the Junior Academy. Participation in these events increased greatly during 1955-1956. They were attended by approximately 1400 students and 236 projects were exhibited. From these, 65 individual and 10 club displays were qualified for entry at the May meeting of the Virginia Junior Academy of Science.

ANNUAL MEETING

The annual meeting of the Junior Academy was held at Hotel Jefferson, Richmond, May 10 and 11. Sixty-six individual and ten club displays were exhibited.

Senior scientists advised students on their scientific careers and discussed their projects with them.

On the evening of May 10, the Junior Academy was host to the Virginia Academy of Science and members of the National Geographic Society at a most excellent illustrated lecture. Mr. Newman Bumstead, Assistant Chief, Cartographic Staff, National Geographic Society presented the lecture "Atlantic's Farthest Shores," and showed pictures filmed to depict human activities and geographic contrasts around the Atlantic Ocean's shores.

At the awards hour on May 11, Dr. Willard Libby, Vice-Chairman of the Atomic Energy Commission, gave a very inspirational talk concerning scientific opportunities for the youth of today.

Increased awards to exhibitors were made possible by a grant from Philip Morris, Inc. The Philip Morris Achievement Awards were given to first, second and third place winners in each of four categories: Physics, Chemistry, Biological Sciences and Miscellaneous Sciences. The awards were as follows:

Club Awards:

1st—Newport News H. S. "Peninsula Soil and Its Resources" Sponsor—Mr. James Mays—$50.00

2nd—Thomas Jefferson H. S., Richmond—$30.00. "Group Work in Biology"—Sponsor - Miss Virginia Ellett

3rd—Awarded to two because of tie in judges' decision. Lane H. S., Charlottesville—$20.00, "Resperine Effect on Activity of Hamsters." Sponsor - Miss Martha Duke. Buckingham Central H. S.—$20.00,

"Mineralogoy of Buckingham County"—Sponsor - Mr. O. P. Sadler

Philip Morris Achievement Awards:

Chemistry

1st—James Talbert, Mt. Vernon H. S., Alexandria, "Sea Water" —$50.00.

2nd—Brent Davis, Mt. Vernon H. S., Alexandria, "Technology of Diazo Chemistry and Its Uses in Industry and Education" $30.00.

3rd—Barbara Chaffin—Martinsville H. S., "Combining an Additive Latex to Paper"—$20.00.

Physics

1st—John Williams, Jefferson H. S., Roanoke, "Electronic Simulation of Human Speech"—$50.00.

2nd—David Carpenter—Jefferson, H. S., Roanoke, "Electrostatic Generator"—$30.00.

3rd—Myrl Grant, Cradock H. S., Norfolk County, "Cathodic Protection"—$20.00.

Biology

1st—Reuben A. Clay, Armstrong H. S., Richmond, "Effects of Pitressin on the Skeletal Development of Young Male Albino Rats"—$50.00.

2nd—Suzanne Wright, Lane H. S., Charlottesville, "The Living Lake"—$30.00.

3rd—Mary Marshall Doyle, William Fleming, Roanoke, "Experimental Study of Earthworms"—$20.00.

Other Sciences

1st—Harold Marsh, Maggie Walker H. S., Richmond, "Set Theory"—$50.00.

2nd—Philip Ingersoll, Douglas Freeman H. S., Richmond, "Ecological Studies of the Fiddler Crab in Tidewater Virginia" —$30.00.

3rd—David Lundquist—Newport News H. S., "Special Theory of Relativity"—$20.00.

Honorable Mentions:

Chemistry

Ardelia Brown, Booker T. Washington, Norfolk, "Effects of Ultrasonics on the Chemical Decomposition of Wood Fibers."
David Peter Yens, Mt. Vernon H. S., Alexandria, "Plastics."

Physics

Blythe Moore, Thomas Jefferson, Richmond, "A Refracting Telescope."
Erwin Gladstone, Woodrow Wilson H. S., Portsmouth – "Transistors."
Edward Webb, Newport News H. S.–"Television Station."
Benton Durley, Falls Church H. S.–"Manipulator."

Biology

Maxine Jennings, Halifax H. S.–"Development of Black Shank in Tobacco"
Bob Terry, Halifax H. S.–"Embryology of a Snail."

Other Sciences

Rudolph Bland, Thomas Jefferson H. S., Richmond–"Rocks and Minerals."
Sonny Rowles, Halifax H. S., "8-inch Reflector Telescope."

E. C. L. Miller Award

Eagle Rock High School, Mr. W. W. Cash, Sponsor.

Major W. Catesby Jones Award

Philip Ingersoll, Douglas Freeman H. S., Richmond (for outstonding work in research).

Honorary Memberships in AAAS;

John Williams, Jefferson H. S., Roanoke.
Reuben Clay, Armstrong H. S., Richmond.

Honorary Memberships in VAS;

Ernest C. Hibble, Cradock H. S., Norfolk County.
Ardelia Brown, Booker T. Washington, Norfolk.

Teacher-Sponsor Scholarships

University of Virginia
Alan Mandell, Cradock H. S.
Alternate—Miss Virginia Ellett, Thomas Jefferson, Richmond.

College of William and Mary
Miss Frances Hurt, Andrew Lewis, H. S., Salem.
Alternate—James Mays, Newport News H. S.

The following new officers were elected:

President—John Towler, Halifax High School.
President-Elect—Ashton Rudd, Andrew Lewis High School.
Secretary—Suzanne Wright, Lane High School.

THELMA C. HEATWOLE, *Chairman.*

JAMES RIVER PROJECT

FINANCIAL STATEMENT AS OF APRIL 30, 1956

Total copies distributed as of April 30, 1955	533
Balance on deposit Peoples National Bank, Lexington, Va. (as of April 30, 1955)	$165.90
Complimentary copies distributed between May 1, 1955 and April 30, 1956	10
Copies sold at $6.00 between May 1, 1955 and April 30, 1956 (3)	$ 18.00
Total copies distributed between May 1, 1955 and April 30, 1956	13
Deposited in Peoples National Bank between May 1, 1955 and April 30, 1956	$ 18.00
Account in Trust Dept., First and Merchants National Bank, Richmond, Va.	$1636.00
Total balance in Peoples National Bank, April 30, 1956	$ 183.90
Total to credit of James River Project as of April 30, 1956	$1819.90
Total copies of Monograph distributed between May 11, 1950 and April 30, 1956	546

MARCELLUS H. STOW, *Chairman.*

REPORT OF COMMITTEE ON CONSERVATION

Your Conservation Committee during the past year concerned itself with two main activities: keeping abreast of conservation education developments in the Commonwealth, and giving aid and moral support to meaningful and worthy conservation education projects at the state level.

Once again the Committee gave endorsement to the annual conservation essay contest in the schools sponsored by the Virginia Commission of Game and Inland Fisheries and the Virginia Division of the Izaak Walton League of America. This was the ninth year of the contest with more than 10,000 school pupils participating.

Though unable to give financial aid to the project, the Committee endorsed the publication of the booklet, *A Look at Virginia's Natural Resources,* published by the Virginia Resource Use Education Council. Also, the Committee has helped with publicity on the new conservation workshop for teachers to be held at the Virginia Polytechnic Institute, June 13-29, 1956. Various agencies and industrial firms contributed a total of $2450 in scholarship funds for this short course in natural resources, to be apportioned in $100 teacher scholarships. Similar workshops in conservation for teachers are planned at other institutions of higher learning in Virginia next year.

No special meetings of the Committee were held but contact with members was maintained by correspondence.

A. J. SHOMON, *Chairman.*

REPORT OF COMMITTEE ON VIRGINIA FLORA

The work on the State flora develops slowly but we feel that progress is being made. The majority of those on the committee have little or no time, in connection with their position, to conduct intensive studies of the flora. Dr. Patterson is actively developing studies of the mosses. Two of his papers dealing with the moss flora have been published during the year. Miss Artz, through illustrated lectures and nature study groups, has contributed to the better appreciation of native plants and of conservation. Such work is of importance in connection with the development of studies of the flora. Miss Dorothy Crandal, of Randolph-Macon Women's College, has reported, in Rhodora, the occurrence of the rare oconce bell, *Shortia galaciflora*, in Amherst County near Lynchburg. This is a new species in our flora and represents a range extension northward from the southwestern corner of North Carolina. The question arises as to whether the colony represents a natural range extension or have the plants been planted by man. Mr. Scruggs, editor of Daily Advance in Lynchburg, states that he had known of the occurrence of the species in the Amherst Co. station for 40 years. This fact does not preclude its having been planted by man. In April Professor Freer and Massey visited the station.

The development of a State herbarium at Virginia Polytechnic Institute has been greatly promoted by the recent acquisition of three large all metal herbarium cabinets in addition to those on hand. The heirs of Dr. E. A. Smyth, Jr., former Prof. of Biology at Virginia Polytechnic Institute, have donated his private collection to the Virginia Polytechnic Institute herbarium. This is a very welcomed contribution. The collection contains species collected in South Carolina as well as in Virginia. Many of the specimens are over 50 years old.

Mr. F. W. Hunnewell, an Associate of the Gray Herbarium of Harvard University, has contributed several hundred specimens collected in northern Virginia. Mr. Hunnewell, of Wellesley, Massachusetts, has a summer home near Winchester, Virginia. He has made several valuable contributions to the State collection at Virginia Polytechnic Institute of specimens from his private herbarium.

Virginia Polytechnic Institute has issued, altogether, six bulletins relative to the plant life of the State. Two of these, Medicinal Plants and Virginia Ferns, are out of print. The bulletin on Poisonous Plants is in the second edition. The third edition of the Farm Weed bulletin, which deals with the weed flora, will be issued this spring. A new bulletin, seventh of the series, on Legumes of Virginia will probably be released in June. Manuscripts on other phases of the flora studies are in progress.

A. B. MASSEY, *Chairman.*

REPORT OF THE VIRGINIA INSTITUTE FOR SCIENTIFIC RESEARCH

The past year has been one of real progress for the Institute. Some noteworthy work has been done, and the Institute is stronger both in staff and in its financial position.

Principal research fields at the Research Institute are (1) surface chemistry, particularly with the aid of the large single crystal, (2) characterization of proteins and other macromolecules, (3) solid state physics, and (4) crystal growth phenomena.

During the past year Dr. Henry Leidheiser, Jr., has been appointed Assistant Director of the Institute. He continues also in his capacity as a Research Supervisor, in charge of the surface chemistry and crystal growth work. Other Research Supervisors are Dr. Carl J. Likes, in charge of the heavy molecule studies, and Dr. G. Wayne Clark, in charge of the solid state physics group.

The staff has grown so that it will shortly include 12 full-time and 2 part-time professional people plus 5 non-professional people in research and 6 people in administration, or a total of 25. Notable additions to the staff have been Dr. Robert A. Lefever, a graduate of M. I. T. in inorganic chemistry, and Dr. James F. Kirn, a graduate of Michigan State in physical chemistry.

Dr. Henry Leidheiser, Jr., received the Westinghouse Brake and Signal Company Ltd. Prize, 1954, for "the most valuable advance in the science or practice of electrochemistry."

This prize is administered by the English Institute of Metal Finishing, whose publications Committee selects the Prizeman.

There are at present eleven major research projects and some minor projects in progress. The income from research contracts is expected to reach $170,000 in 1956, almost double the amount last reported. The present facilities of the Institute are 82% full and will be completely filled by midsummer. Plans are now being made for additional space, which will be urgently needed soon.

F. C. ARMISTEAD, *Director.*

REPORT OF THE ADVISORY COUNCIL ON EDUCATION IN THE SCIENCES

The activities of the Panel during the past year have been focused on the gathering of information and the presentation of two programs at the Annual Meeting of the Academy. The information assembled includes facts and statistics and many expressions of concern on the apparent shortage of scientists and engineers and the need for the maintenance of good instruction in the sciences and mathematics. The Panel is now in a position to provide information and has offered to assist in an advisory capacity to those interested in the State government, industries, and in public education.

The program for the Symposium on the Shortage of Teachers of Science and Mathematics, of which the Panel was a co-sponsor with the Manpower Committee of the Virginia Section of the American Chemical Society and the Science Teachers Section of the Virginia Academy of Science, is presented elsewhere in the Proceedings of the Annual Meeting. The Symposium was enthusiastically received. In the discussions members of the Academy and others expressed a variety of opinions and made valuable suggestions for action. The Panel is particularly indebted to members of the State Board of Education who participated in the Symposium and who expressed a willingness to use facilities of the Virginia Academy of Science where appropriate. The consensus of the Panel was that, through the cooperate efforts fo all concerned, much could be accomplished to insure that Virginia has adequate science and mathematics instruction in the public schools.

The Advisory Panel also had an open meeting on Saturday morning of the Annual Meeting of the Academy for more informal discussion of the issues and for formulation of resolutions. After considerable discussion the following resolution was passed and forwarded to the Academy Council for further consideration:

> "Being deeply concerned about the shortage of scientists and engineers and aware of its responsibility, the Virginia Academy of Science desires to cooperate fully with the State Department of Education. Therefore, be it resolved that a committee be appointed to represent the Virginia Academy of Science to work with the State Department of Education if and when requested, in strengthening the qualifications for high school science teachers, and in other ways to improve science and mathematics instruction in the public schools of Virginia."

A second resolution was passed to the effect that the Panel would encourage the establishment of local action committees to develop programs which would help in meeting the needs of the various areas of the State. Area chairmen will be appointed and requested to work

during the year with the view of reporting at the next annual meeting of the Virginia Academy of Science.

The Advisory Panel has established contact with the Virginia Advisory Legislative Council, which is a study group of the Virginia General Assembly. The V.A.L.C. has been instructed, through a joint resolution of the General Assembly, to gather information and to determine whether additional steps should be taken at the State level to maintain an adequate supply of scientists and engineers and teachers of the subjects.

JAMES W. COLE, JR., *Chairman.*

REPORT OF THE COMMITTEE ON AWARDS

The Committee on Awards during the year 1955-56 has suggested two names to he Council for receiving Distinguished Service Awards. These were Dr. W. T. Sanger, President of the Medical College of Virginia, and Dr. Ivey Lewis, former dean at the University of Virginia. These two nominations were approved by the Council and Distinguished Service Awards are to be presented at the Annual Meeting of the Academy Friday, May 11.

The question of Honorary Life Membership was made a major issue during this year by the presentation of seven or eight prominent scientists and former active members of the Academy. It is the feeling of the Awards Committee that some definite policy should be set up for handling Honorary Life Members and that men such as we have been considering be given some recognition.

BOYD HARSHBARGER, *Chairman.*

REPORT OF THE VIRGINIA JOURNAL OF SCIENCE

Following the appointment of H. H. Hobbs, Jr., as Editor and B. F. D. Runk as Managing Editor by the Council of the Academy at the Annual Meeting at Harrisonburg in May of 1955, the editorial and business office of the Virginia Journal of Science was moved from the Department of Statistics at Virginia Polytechnic Institute to the Alderman Library of the University of Virginia on June 3, 1955.

Since that time all back copies of the original and new series of the Journal have been brought together in one location.

Despite mounting costs the Journal has retained its sound financial status as originally established by its former distinguished Editor-in-Chief, Dr. Boyd Harshbarger. Its circulation continues to grow, and as indicated in the report of distribution on pages 91-94 of the April, 1956, issue, the Journal reflects credit on the Commonwealth, its institutions, and the Virginia Academy of Science.

Financial statements are at best dull. I shall turn the detailed audited statement over to the Council for its careful study and consideration. Let me briefly state that receipts this year amounted to $2,946.79, expenses to $2,559.73. With all bills to date paid, there is a cash balance in the bank of $2,891.02. The Journal has $2,655.23 in the savings account and thus has a total favorable balance of $5,546.25.

B. F. D. RUNK, *Managing Editor.*

FINANCIAL STATEMENT
VIRGINIA JOURNAL OF SCIENCE

OPERATION STATEMENT FOR THE FISCAL YEAR
VIRGINIA JOURNAL OF SCIENCE
May 10, 1955 - May 10, 1956

RECEIPTS:

Academy Subsidy	
Regular members 948 at $2.00	$1,896.00
Student members 62 at $1.25	81.25
Advertising	320.90
Subscriptions	348.55
Miscellaneous (Sexton Foundation)	300.00
TOTAL OF ALL RECEIPTS	$2,946.70

EXPENDITURES:

Reprints	$ 131.80
Printing	1,874.40
Engraving	117.89
Index	52.00
Freight	65.43
Postage	130.00
Office Supplies	171.62
Miscellaneous	16.59
TOTAL OF ALL EXPENDITURES	$2,559.73

STATEMENT OF CASH ACCOUNT:

Balance of cash at beginning of year	$2,504.05
Total receipts for year	2,946.70
Total cash on hand during year	5,450.75
Total expenditures for year	2,559.73
Balance of cash at end of year (checking account)	2,891.02
Balance in savings account	2,655.23
TOTAL	$5,546.25

Audited by: Ladley Husted and Jacques Rappaport. May 10, 1956

VIRGINIA JOURNAL OF SCIENCE

ACCOUNTS RECEIVABLE

MAY 10, 1956

Dombrower Advertising Agency April, 1956 Issue	$ 24.90
Eastern Advertising Associates April, 1596 Issue	24.90
American Tobacco Company January and April, 1956 Issues	58.80
Miss Frances Myers Subscription—Armed Forces Med. Lib.	2.55
TOTAL	$111.15

Audited by: Ladley Husted and Jacques Rappaport. May 10, 1956

REPORT OF JAMESTOWN EXPOSITION COMMITTEE

By letter of November 3, 1954, President Foster appointed William G. Guy, Horton H. Hobbs, Jr., and the undersigned as a "committee to meet with the Jamestown Celebration Committee and explore the avenue of cooperation between this group and the Virginia Academy of Science."

In May 1953 the chairman presented a report to the Long Range Planning on a meeting with Mr. Parke Rouse, Jr., Executive Director of the Virginia 350th Anniversary Commission. Four possible aspects of cooperation with the Jamestown Celebration Committee were considered:

1. Put attractive jacket on copies of the James River Monograph and sell the volumes at the Exposition for $2.50 - $3.00.

2. Issue a special Jamestown Celebration number of the Virginia Journal of Science. It would be for sale during the year of the celebration.

3. Develop appropriate exhibits in conjunction with other exhibits devised by the Jamestown Committee.

4. Hold a special Academy meeting during the Celebration year.

The Special Committee decided that item 4 would be impractical and recommended no further consideration of it. Mr. Rouse was enthusiastic about the possibility of participation by the Academy in the Celebration and at a later date wrote, "I gave our Commission a resume of our brief discussion when it met here last week, and I want to report that considerable interest and enthusiasm was shown. We hope you will be able to go through with all your plans, and we'll be glad to do anything we can to help you."

On June 19, 1955, President Flory appointed the above Survey committee as an Academy Committee to "carry out the recommendations made to the Long Range Planning Committee in May. Stow was requested to arrange for the design and printing of a jacket for the James River Monograph and Hobbs was asked to develop the special issue of the Journal.

At the conference with Mr. Rouse, the Special Committee was informed that details concerning exhibits at the Festival had not been determined and that in all probability space would be at a premium. In March 1956 Dr. Guy consulted Mr. Rouse about Academy participation in exhibits and was informed that, "In view of our limited exhibit space, and the fact that the governments of Great Britain and the Commonwealth of Virginia are to provide the two principal exhibits, I cannot at present see opportunity for the Academy to participate in this

manner. Should we need your help with the Virginia exhibit, however, I will let the Academy know through you." At a later date Mr. Rouse suggested to President Flory that the Academy develop its exhibit at Williamsburg, possibly at the College of William and Mary. After consideration of these facts it is recommended that the Academy not attempt to develop exhibits for the Jamestown Festival.

Dr. Hobbs has made excellent progress in the organization of material for the special issue of the Journal of the Virginia Academy of Science. The issue will be composed of five chapters on the following topics: History of Science in Virginia by Ivey F. Lewis, Fisheries by J. I. McHugh, Geology by Arthur Bevan, Indians by Bruce D. Reynolds, and Medicine by Sidney S. Negus. An appropriate cover is being designed for the Special issue.

Arrangements have been made with an artist in Richmond for the design of the jacket for the volume on the James River Basin, in keeping with the spirit of the Jamestown Festival and the Monograph.

MARCELLUS H. STOW, *Chairman.*

REPORT OF THE SPECIAL COMMITTEE ON ACADEMY INCOME

This committee was directed to investigate sources of revenue available to the Academy. A full report is recorded in the Minutes of the meeting of the Council, May 10, 1956. Its conclusions are as follows:

(1) The largest potential for increased income lies in an increase in business memberships. A concerted and organized campaign to obtain such memberships should bring in a good return, judging by the past experience of the Finance Committee. If a large increase in income is desired the committee recommends such an effort.

(2) A real effort to increase the number of sustaining and contributing members might be made. This could conceivably increase our income by $1000. We recommend that this be tried.

(3) The committee is sharply divided over the desirability of raising dues. No increase of more than $2000 could possibly be netted in this way, if dues were raised to $5.00. This step is not recommended.

Considering the present financial situation of the Academy, the committee feels no sense of urgency in embarking upon any of the three steps above.

I. G. FOSTER, *Chairman.*

REPORT OF THE MEMBERSHIP COMMITTEE

For the calendar year 1956 new members were obtained as follows:

Regular members	50
Student members	20
Business members	4
TOTAL	74

Losses for the calendar year 1955 (all classes) were:

Senior members	78
Student members	11
TOTAL	89

As of April 1, 1956, the membership of the Academy was made up as follows:

Regular members	734
Business members	13
Contributing members	50
Sustaining members	30
Life or honorary members, and Patrons	14
Student members	50
TOTAL	891

ROBERT F. TRUITT, *Chairman.*

MINUTES OF THE SECTION OF AGRICULTURAL SCIENCE (1)

R. W. ENGLE, Blacksburg, *Chairman*

P. M. REAVES, Blacksburg, *Vice-Chairman*

J. W. MIDYETTE, JR., Richmond, *Secretary*

CARL W. ALLEN, Blacksburg, *Section Editor*

FRIDAY, MAY 14, 1956 — 9:00 A.M. — EMPIRE ROOM, JEFFERSON HOTEL

1. MOISTURE RELEASE CHARACTERISTICS OF VIRGINIA TYPE PEANUTS ON DRYING.

D. L. Hallock; *Virginia Agricultural Experiment Station, Holland.*

A study of the miosture release characteristics of peanuts was conducted in an attempt to find ways of eliminating inconsistent variations in results from peanut experiments. Several temperature levels were investigated as bases for expression of results because peanuts, particularly shells, are very hygroscopic and a definite and reproducible basis is essential.

Unshelled peanut samples of similar moisture content at the start of the experiment were placed in a forced draft oven, one new lot with each increase in temperature, and heated to constant weight at 9 different temperature levels over an 18-day period. In each case over a range of 110° to 210°F., the samples followed the same drying curve as those previously or subsequently placed in the oven. No loss in weight occurred on prolonged heating at any of the temperature levels, after initial equilibrium.

In another experiment, 10 lots of shelled and unshelled peanuts varying in initial moisture content were heated to constant weight at 150° and 190° F., and then dried at 266°F., according to the A.O.C.S., Official Method Ab2-49. Peanut shells at equilibrium at 150° and 190° F. retained slightly more moisture (266°F. basis) than did the kernels, whether or not the samples were shelled prior to drying. The difference between the moisture content of the shells and the kernels, however, was much greater at higher moisture contents. Hence in grading peanuts, shelling percentages and related data are influenced appreciably by variations in moisture content.

2. A COVER CROP STUDY IN SOUTHWESTERN VIRGINIA.

A. H. Allison and D. L. Hallock; *Smith-Douglass Co., Inc.* and *Virginia Agricultural Experiment Station.*

Peanut yields were not influenced appreciably by either rye grass or crimson clover cover crops. The application of fifteen pounds of nitrogen per acre under peanuts after rye grass resulted in a slight decrease in per cent of sound mature kernels. Removal of the cover crop forage prior to plowing had no effect on yield or grade of peanuts.

The highest yields of corn were obtained where sixty pounds of nitrogen per acre were plowed under with crimson clover. Corn production following crimson clover and without supplemental nitrogen was approximately equivalent to plots having no cover crop but on which sixty pounds of nitrogen were plowed down prior to planting. Corn following rye grass produced lower yields than where it followed crimson clover or no cover crop.

Crimson clover yields were considerably higher planted after corn than after peanuts whereas little difference was noted in rye grass yields.

Greater response to treatments would, in all probability, have been obtained on soils having a lower fertility level.

3. EFFECT OF LIME ON ROCK PHOSPHATE AVAILABILITY.

W. W. Moscher; *Virginia Agricultural Experiment Station.*

The effect of three forms of lime on the availability of row rock phosphate to two crops, alfalfa and millet, was studied on two soil types, Wellston fine sandy loam and Davidson clay loam, in the greenhouse. Changes in soil properties associated with liming, including pH, exchangeable bases, base exchange capacity, and percentage base saturation were also determined. Lime reduced the availability of rock phosphate to both millet and alfalfa but yields of the latter on Wellston were nevertheless increased by the use of lime, apparently due to the benefits of lime to alfalfa outweighing the reduction in availability of the rock phosphate.

4. A PRACTICAL FIELD DETERMINATION FOR NITROGEN CONTENT OF ANHYDROUS AMMONIA FERTILIZER.

Maurice B. Rowe; *Virginia Department of Agriculture.*

This method was adopted for use by Virginia Fertilizer Regulatory inspectors and represents the result of numerous field trials and consultations with producers of Anhydrous Ammonia and State Fertilizer Control Officials from other States.

Equipment recommended.—Ammonia respirator, rubber gloves, pyrex

glass cylinder graduated at 100 ml. with nipple graduated to 1 ml. in 1/10 subdivisions, couplings and reducers ranging from 1/4 to 1 1/2 inches, a 14 inch pipe wrench and several crescent wrenches, a 1/2 gallon bucket, several rubber stoppers with everflow glass tube in center and a cone shape funnel with 1/4 inch opening for passage of NH_3 to cylinder and to which is attached necessary fittings for connecting to source of NH_3.

Procedure (Operator wears rubber gloves and ammonia respirator when exposed to NH_3).—Make connection between storage tank outlet and sampling equipment with proper couplings and reducers. Check all equipment for leaks and open valves for flushing out equipment. After rapid flushing, close valves until ready to collect sample. Collect sample by withdrawing liquid ammonia into pyrex cylinder up to 100 ml. mark. Place rubber stopper into open end of pyrex cylinder quickly and place tube end of cylinder in water bath. Vapor ammonia will boil off through hole in stopper. When all liquid is boiled off, operator observes residue left which is measure of degree of purity.

5. FULFILLMENT OF FUTURE NEEDS OF AGRICULTURAL SCIENTISTS.

Edwin Cox; *Virginia-Carolina Chemical Corporation.*

Requirements for Agricultural Scientists in future years exceed available supply. This deficit is common also to other fields of physical and life sciences and engineering professions. This condition is our infirmity which Soviet strength threatens more seriously than by competition in weapons. The Agricultural Research Institute, an agency of the National Research Council, is seeking means of correcting this status. It has no immediate answers. The ARI, Agricultural Board, National Research Council, and National Academy of Sciences organizations are reviewed. Diverse scientific groups represented are cited.

The need for increased scientific personnel is not limited to a single science or discipline. Current competition, uncontrolled, is creating confusion. With shortage in supply, there is the risk of lowering standards so that the deficiency may be in quality as well as quantity. The problem is not one of a separate segment of "Agri-industry"—it involves education, scientific agencies, agriculture and industry and our national welfare. No single group can solve the problem. Recruitment is a duty of all engaged in Agricultural Science, and one which cannot be delegated. It requires the individual effort of all. Assistance and advice of the Agricultural Science Section of the Virginia Academy of Science is besought.

6. POSSIBLE EFFECTS OF *OASI*[1] ON AGRICULTURAL RESOURCE USE AND NEEDED RESEARCH.

W. L. Gibson, Jr., *Virginia Agricultural Experiment Station.*

The impact of the old-age retirement and survivors benefits insurance program (OASI) upon agriculture will have its principal influence upon farm land tenure and conservation.

Many landlords may change their rental arrangements to permit them to participate in the retirement program through their farm businesses. After coverage is accomplished, they will shift back to a leasing arrangement. Undoubtedly, these shifts will increase the instability in our tenure system, and they could be a source of considerable misallocation of resources in agricultural production. Research will be needed to determine remedial measures to minimize the disruptive effects.

OASI will discourage conservation through the increasing tax rate between 1955 and 1975, and through attempts of farmers to increase income in the years just previous to their 65th birthday in order to qualify for maximum benefits. Both factors will increase farmers' preferences for present income over future income.

Perhaps the most important need for research is to determine the effect of OASI on the rate of capital accumulation in agriculture. It appears that collection of taxes from young people for payment of benefits to retired people and from people among the high-income groups for benefit payments to those in the low-income groups will reduce capital accumulation.

7. COMPETITIVE RELATIONSHIPS BETWEEN CORN AND SOYBEANS FOR USE OF LAND IN VIRGINIA.

Carl W. Allen; *Virginia Agricultural Experiment Station.*

For profit maximization, farmers' decisions on which of several independent competitive crops with constant rates of substitution to produce should be based on product substitution and price ratios and on per acre costs of production. Relevant resource substitution rates in crop production have been inadequate for making rational decisions.

A sample of farms having one or more fields of Sassafras or Rumford soils planted to corn or soybeans were surveyed in 1954. Restrictions placed on the sample to provide homogeneity included: variety planted must have been on recommended list, corn to be for grain, soybeans to be harvested for beans, drilled in rows and not following another harvested crops in 1954, only tractor power used (no team), and a minimum size placed on the field.

Specific input data were collected relating to (a) land preparation, planting, cultivating and harvesting, (b) disease and insect control, (c) depth and time of planting, (d) rate of planting, and (e) soil productiv-

[1] OASI refers to the Old-Age Retirement and Survivors Benefits Insurance Program of the Social Security Administration, U. S. Department of Health, Education and Welfare.

ity and fertility measurement and maintenance. Costs directly associated with each enterprise were obtained. These were separated from fixed costs. Separate estimates have been derived of the "break-even" price between corn and soybeans for the two contrasting soils. On the Sassafras soil with corn at $1.20 per bushel, preliminary estimates indicate that soybeans must be slightly over $3.00 per bushel to be as profitable as corn. The figure for Rumford is about $2.20.

8. EFFICIENCY STUDY OF PIPELINE AND CONVENTIONAL MILKING SYSTEMS.

Paul M. Reaves and Wm. E. Blalock; *Virginia Polytechnic Institute.*

The pipeline system of milking consists of a vacuum pipeline to which standard milking equipment is attached. This glass pipeline carries the milk into the milk room and releases it into cans or a bulk cooling tank.

The pipeline may be installed in a milking parlor or in a conventional dairy barn. In-place-cleaning procedures have been developed.

A pipeline system was installed in a 56 cow dairy barn at VPI in July 1954. Prior to its installation two men operated two milker units each and a third man carried the milk to the milk room.

After the pipeline installation the two men operate two units each and the pipeline carries the milk. Under these conditions the pipeline system requires the same amount of time for actual milking, but with one less man. Thus, one-third of the labor is saved. For the entire milking operation, including assembling, disassembling and cleaning, there was a saving of 22 per cent in man hours.

9. A COMPARATIVE CASE STUDY OF TWO SYSTEMS OF DAIRY BARN OPERATIONS.

R. Lee Chambliss, Jr., *Virginia Agricultural Experiment Station.*

To determine the relative labor requirements of the chore work, under winter conditions, and the relative capital requirements, in a conventional stanchion barn and in a milking parlor-loose housing arrangement, data were collected in December and January from two dairy farms in Virginia.

The stanchion barn housed 126 cows, of which 107 were milked with conventional milking machines. All cows were hand fed in the barn. Three men were required in the chore work.

In the other system 160 cows were loose-housed and largely self-fed. Of these 125 were milked in a six-stall walk-through pit-type milk-

ing parlor by two men using a pipe-line milking system. In this set-up two men cared for more cows than three men in the stanchion barn.

In the stanchion barn the total labor requirements for chore work were 17.5 man-minutes per cow milked per day, whereas in the milking parlor-loose housing system the requirements were 10.1 man-minutes, or a saving of 42% in labor requirements per cow milked. The investment in facilities for the latter system was about $200 per cow milked, as against $400 to $600 for comparable facilities in the stanchion barn.

10. HOW GOOD ARE SLAUGHTER CATTLE AND CALVES CONSIGNED TO SOUTHERN AUCTION MARKETS.

Roy G. Stout; *Virginia Agricultural Experiment Station.*

Preliminary results of a study conducted jointly by the states of Alabama, Georgia, Louisiana, South Carolina, Tennessee, Virginia, and West Virginia showed that 45% of all slaughter cattle and calves sold at the 32 southern auctions in the study were of beef type breeding. Dairy animals composed 15% of the total sales of slaughter cattle and calves and mixed breeding accounted for 32% of all sales. Brahman breeding accounted for the remaining 8%.

The distribution of all slaughter cattle and calves at the auctions studied during selected periods of 1953-1955, by market classes, revealed that 17% of all animals were veals, 24% slaughter calves, 24.2% steers, 15.4% heifers, and 19.4% cows.

For the purposes of analysis, the region was sub-divided into 4 areas. Area III was composed of 4 markets in Virginia, 3 in West Virginia, and 1 in Tennessee. The average grade of veal calves (on the basis of the standards of the United States Department of Agriculture) was High Commercial. Sixty-two percent of all veals were sold in Area III. The average grade of veals for Area III was Low Good. The average grades of the other market classes for the region were as follows: slaughter calves, High Commercial; steers, Low Commercial; heifers, High Utility; and cows, Medium Cutter.

11. BREEDING FROST HARDY PEACHES AND NECTARINES FOR VIRGINIA.

George D. Oberle; *Virginia Agricultural Experiment Station.*

Frosts and freezes during the peach blossoming seasons of 1949, 1950, and 1953 destroyed most of the crop on trees of peach and nectarine in the variety testing orchard of the Virginia Agricultural Experiment Station. A wide range of variability in response to the freezes was observed. The ability of some varieties to withstand the effects of freezes suggested that breeding for this characteristic might result in production of frost hardy commercial types of peaches and nectarines.

All crosses made since 1951 have involved at least one hardy parent. The seasons of 1954 and 1955 gave opportunity to evaluate seedling peaches and nectarines on the basis of their response to frosts and severe freezes. These observations indicated beyond question that ability to withstand blossoming season frosts is of a hereditary nature and can be transmitted to succeeding generations. Approximately 75 seedlings having a high degree of frost resistance were selected in 1955 for propagation for further testing on the basis of their desirable fruit characteristics. These seedlings had been selected in 1954 for further study on the basis of superior fruit characters and heavy yielding ability.

12. THE EFFECT OF MOLASSES SUPPLEMENTATION ON THE DIGESTIBILITY AND CONSUMPTION OF PASTURE HERBAGE BY GRAZING ANIMALS.

W. A. Hardison and J. T. Reid; *Virginia Agricultural Experiment Station* and *Cornell University Agricultural Experiment Station.*

In order to study the effect of molasses supplementation to grazing animals a short-term test was conducted during the 31-day period from August 25 to September 25 in which forage digestibility and consumption of animals grazing pasture with and without molasses supplement were compared. The pasture consisted largely of birdsfoot trefoil with some Kentucky bluegrass. Five Holstein heifers composed the group receiving molasses in addition to pasture while 4 Holstein heifers and one Holstein steer were allotted to the group allowed pasture as the only source of nutrients. The molasses was group fed, *ad libitum*, and the amount consumed was measured daily. The digestibility and amount of forage consumed were estimated by indicator techniques. It was observed that the ingestion of molasses did not appreciably affect the digestibility of the herbage dry matter; however, it did result in a marked reduction in the amount of pasture herbage consumed.

13. SOME CHEMICAL CHARACTERISTICS OF SHEEP AND GOAT FIBERS.

Lubow A. Margolena; *Animal and Poultry Husbandry Research Branch, United States Department of Agriculture.*

In conjunction with other studies on the influence of season on skin and fiber follicles, representative samples of wool of Merino and Hampshire sheep and hair of Toggenburg goats were tested periodically throughout a whole year at Beltsville, Maryland, for moisture content. Simultaneously hydrogen ion concentration and ammonia nitrogen content were determined in aqueous solutions.

Certain species and sex differences were found to exist between these animals as follows:

1. Goats' fibers showed a lower pH, average 6.5, and contained

more ammonia nitrogen, average 200 μg/g, as compared to those of sheep, 7.75 and under 75 μg/g respectively. Variability in pH was higher in sheep than in goats.

2. Variability in water content was higher in Merino sheep than in Toggenburg goats. Hampshire wool carried a greater percentage of water than Merino wool, namely 12.0% as compared 9.2%.

3. In both Merino and Hampshire sheep, the wool of ewes 10.2% and 12.8% respectively, carried more water than rams' wool, 8.1% and 11.1%, respectively.

14. EFFECTS OF HEXACHLORONAPHTHALENE ON VITAMIN A METABOLISM IN THE RAT.

G. E. Bunce and R. W. Engel; *Virginia Agricultural Experiment Station.*

In vivo studies were undertaken to investigate the effects of hexachloronaphthalene on vitamin A metabolism and carotene conversion in the rat. It was found that dietary hexachloronaphthalene would accelerate the appearance of vitamin A deficiency symptoms in weanling rats on a vitamin deficient diet without specifically destroying the stores of the vitamin in the liver.

The rate of carotene conversion was markedly lowered when hexachloronaphthalene was included in the diet. This decline in conversion rate appeared to stem from some metabolic malfunction other than a lack of available bile salt. In contrast, hexachloronaphthalene did not noticeably interfere with the mechanisms involved in the absorption and storage of a single oral dose of vitamin A palmitate.

15. BEAN SEED TREATMENT TRIALS IN EASTERN VIRGINIA.

T. J. Nugent and R. N. Hofmaster; *Virginia Truck Experiment Station, Norfolk.*

Numerous trials have been made with various fungicide-insecticide combination seed treatments on snap and lima beans for the prevention of seed decay and/or injury by soil insects. The effects of time in storage and storage temperatures on treated seed were also studied. Seed treatments were applied as a slurry.

When seed-corn maggots were a factor, insecticides used alone gave increased stands and yields compared to the untreated seed, but their performance was enhanced when combined with fungicides. Some response was noted when fungicides were used along on lima beans but not with snap beans. In most of the trials combination treatments increased stands and yields compared to treatments in which the ma-

terials were used separately, or where no treatment was applied. Fungicide combinations with aldrin, dieldrin or heptachlor gave better results than combinations with lindane. In this respect no differences were evident between the fungicides Arasan SF-X and Orthocide 75. The various treatments had no detrimental effect on seed stored for two to three months and gave results similar to treatments made just prior to planting. However, dieldrin was superior to aldrin, heptachlor, or lindane when the treated seed was stored for one year prior to planting. Storage temperatures ranging between 45° and 100°F. for a period of three months had little effect on the germination of snap bean seed, but the 100°F. temperature reduced the germination of lima bean seed considerably. This high temperature also resulted in loss of some of the insecticides, particularly lindane, aldrin and hepachlor.

16. SOME INFLUENCES OF SOIL MOISTURE, DATE OF SAMPLING, FERTILIZER, AND CROPPING ON CERTAIN SOIL TESTS.

E. M. Dunton, Jr., *Virginia Truck Experiment Station.*

The purpose of this study was to determine the influence of the above factors on the soil tests for pH, phosphorus, potassium, nitrate nitrogen and salt concentration, in the surface and subsoil of a Sassafras sandy loam. The surface soil samples were taken at two week intervals and the subsoil samples every two months.

Soil moisture in the surface soil varied markedly with date of sampling and most in the summer time. The percent moisture was greatest on the cover crop side in winter and on the no cover side in summer.

The pH of the surface soil was lowered by the added fertilizer and by the presence of soluble salts as indicated by the nitrate and salt concentration. The percent soil moisture at time of sampling did not appreciably influence the soil reaction. The nitrate nitrogen and soluble salt content of the surface soil increased with fertilizer and was much lower on the cover crop side. The levels on all treatments were markedly lowered in winter time by the flushing effect of rainfall. This is shown by the nitrate-nitrogen content of the subsoil samples. The phosphorus level changed very little with any of the treatments, while the potassium level fluctuated markedly with fertilizer.

17. REVIEW OF PLANT-PARASITIC NEMATODES FOUND IN VIRGINIA DURING 1955.

A. M. Somerville, Jr., and V. H. Young, Jr., *Virginia-Corolina Chemical Corporation, Richmond.*

During 1955, plant and soil samples from many sections of Virginia were examined. From these samples, nematodes of fourteen of approxi-

mately twenty-three known plant-parasitic genera were isolated and identified. The preliminary data accumulated indicate that the scope of the nematode problem is of sufficient importance to warrant a systematic survey.

BUSINESS MEETING

The annual business meeting was held at the close of the session, May 11, 1956. The nominating committee composed of S. F. Thornton, Chairman; Lawrence I. Miller and Rodney C. Berry, presented the following nominees for 1956-57: *Chairman,* P. M. Reaves; *Vice-Chairman,* James W. Midyette, Jr.; *Secretary,* A. H. Allison; *Section Editor,* C. W. Allen.

The report of the nominating committee was accepted and those nominated were elected for next year's officers.

The desirability of interesting 4-H and Vocational Agriculture students in becoming affiliated with the Junior Academy was discussed. It was recommended that this matter be investigated.

MINUTES OF THE SECTION OF ASTRONOMY, MATHEMATICS, AND PHYSICS

J. GORDON STIPE, JR., *Chairman*
MELVIN A. PITTMAN, *Secretary*
FRANK L. HEREFORD, *Section Editor*

FRIDAY, MAY 11, 1956—9:00 A. M.—FLEMISH ROOM JEFFERSON HOTEL

1. PERMEABILITY TENSORS FOR THE PROPAGATION OF TE AND TB MODES IN ROUND WAVE GUIDES.

Edward F. Turner, Jr., and Nicholas Karayianis[1]; *George Washington University.*

An attempt is made to derive the most general form of the microwave permeability tensor of a magnetic material which will allow the propagation of a TE (or TB) mode in a wave guide of arbitrary cross-section filled with the material.

The derivation proceeds from Maxwell's equations. In order to obtain a solution, the following assumptions are made:

(1) The material has a scalar permittivity.

(2) The microwave permeability tensor of the material has an inverse, and the tensor components are independent of the coordinates.

(3) Taking the z-axis as the direction of propagation, then all wave components other than E_z, and all their derivatives are non-zero.

The most general form of the microwave permeability tensor which will give a non-trivial wave equation for the propagation of a TE mode under these conditions is found to be:

$$\mu = \begin{vmatrix} A & O & O \\ O & A & O \\ B & C & D \end{vmatrix}$$

A similar analysis gives:

$$\mu = \begin{vmatrix} A & O & B \\ O & A & C \\ O & O & D \end{vmatrix}$$

as the most general form of the tensor which will allow a TB mode.

1. Now at Diamond Ordinance Fuze Laboratory, Washington, D. C.

2. TRANSVERSELY MAGNETIZED FERRITE RODS IN CIRCULAR WAVEGUIDE.

Nicholas Karayianis; *Diamond Ordnance Fuze Laboratory.*

Some experimental studies of the birefringent phenomena of ferrite rods in circular waveguide are discussed in this paper. These phenomena were investigated experimentally at 9.375 kmc/sec in standard 15/16 inch and reduced circular waveguide. Measurements of insertion loss and phase shift were made as functions of length and diameter of the ferrite rods for two fixed sizes of circular waveguide. Also, similar measurements were made as a function of the diameter of reduced circular waveguide completely filled with ferrite, and two representative size diameters were investigated varying the frequency from 9.0 to 10.0 kmc/sec. It was found that the phase shifts produced by ferrite in reducer circular waveguide are much larger than those produced in standard 15/16 inch guide and that the cutoff effects in reduced guide further enhance the phase shifts.

3. SCATTERING OF POLARIZED NEUTRONS.

Frank L. Hereford; *University of Virginia.*

If polarized neutrons are scattered by a nucleus for which the neutron-nucleus interaction involves spin-orbit coupling, a right-left asymmetry appears in the angular distribution of scattered neutrons[2]. If the magnitude of the spin-orbit term in the scattering potential is known, this right-left asymmetry can be used to determine the degree of polarization of the incident neutrons. Similarly, if the degree of polarization of the incident neutrons is known, the right-left asymmetry yields information about the spin-orbit effects for a particular scatterer. These effects can be described quantitatively and form the theoretical basis of the results presented in the following paper.

4. EXPERIMENTAL RESULTS, POLARIZATION OF D-D NEUTRONS.

B. McCormac, M. Steuer, C. Bond, and F. Hereford; *University of Virginia.*

The polarization of the $d(d,n)He^3$ neutrons as a function of incident deuteron energy and angle from the deuteron target has been investigated. The right over left asymmetry of the neutrons scattered from C^{12} was taken simultaneously by two counters. This C^{12} scatterer was used at an angle which gives 100% efficiency in detecting polarized neutrons. A collimator of wedges of H_2O plus H_3BO_3 plus Pb schielded the 1" by 1" by 1/4" stilbene crystals from the neutron beam. From the measured right over left asymmetry the polarization was computed. Reasonable

2. J. Schwinger, Phys. Rev. 69, 681 (1946).

agreement was obtained with the theoretical calculations made by Blin-Sotyle[3] and Firez[4]. A polarization of 10.6% at θ_1 of 53° was obtained for 600KEV incident deutrons. These polarized neutrons were then scattered from zirconium and carbon to determine the polarization as a function of scattering angle. For carbon, in agreement with Meier *et al*[5], a Sin θ_n dependence was observed. Incomplete results on zirconium indicate some like a Sin $4\theta_2$ dependence.

5. THE PRODUCTION AND SCATTERING OF POLARIZED ELECTRONS.

William G. Pettus; *University of Virginia.*

An investigation has been carried out in order to determine whether or not the polarization of electrons by nuclear single scattering is predicted correctly by the Mott theory. A double scattering experiment was carried out in which a partially polarized beam of electrons was produced by the first scattering as evidenced by an azimuthal asymmetry in the distribution of the second scattered electrons.

These experiments have been carried out in the energy range from 80 to 200 kilovolts and for scattering angles of 60, 90, and 120 degrees. The degree of polarization produced by scattering from gold foils ($0.16^{mr}/_{cm^2}$) was determined relative to that produced by scattering from aluminum ($1.8^{mr}/_{cm^2}$). This procedure of normalizing the observations for gold to those for aluminum allowed the effects of instrumental asymmetries to be minimized.

The results show clearly a polarization effect and its magnitude is considered in satisfactory agreement with the theory for energies above 120 kilovolts. Below 120 kilovolts the measured asymmetries are definitely low and seem to follow the trend observed by Ryu. The observed angular dependence of the polarization asymmetry appears to confirm the recent calculations of Mohr and Tassie which indicate increased asymmetries for angles larger than 90 degrees.

6. SUNLIGHT INTEGRATOR OF WIDE INTENSITY RANGE.

E. W. Glossbrenner and H. Y. Loh; *Virginia Polytechnic Institute.*

A moderately priced sunlight integrator which registers the amount of light received through the entire length of the day has been designed and constructed.

The detecting element is a photomultiplier tube with ample sensitivity to measure early morning and late evening light. As the light changes

[3] R. J. Blin-Stoyle, Proc. Phys. Soc. 65A, 949 (1952).
[4] M. Fierz, Helv. Phys. Acta. 25, 629 (1952).
[5] R. W. Meier, P. Scherrer, and G. Trumpy, Helv. Phys. Act. 27, 577 (1954).

during the day, filters of greater or less density are inserted automatically into the light path to prevent damage to the tube and at the same time to maintain reliability of the measurements.

Six filters are provided to give a complete coverage of the daily range of sunlight intensity, each filter being coupled to a counter recording photoelectric charge accumulated at that filter density.

The phototube is located inside a rotating transparent drum on which are mounted the filters. Rotation of the drum in the proper direction is initiated by variations of sunlight intensity. Precise positioning of the filters and choice of counter is controlled automatically by a specially designed commutator assembly. This allows the instrument to function unattended.

7. ION SOURCE FOR 2 MEV ELECTROSTATIC ACCELERATOR.

J. T. Rogers; *Virginia Polytechnic Institute.*

The r-f ion source constructed for the V. P. I. Electrostatic Accelerator is designed to produce a current of 1.0 ma with a gas consumption of 1 cm at standard temperature and pressure. It is a modification of the Moak and Thoneman designs. Power for the source and associated circuits is provided by a 500 watt permanent magnet alternator. Construction problems and design criteria will be discussed.

8. DESIGN AND CONSTRUCTION OF A MAGNETIC ANALYZER FOR THE V.P.I. ELECTROSTATIC ACCELERATOR.

David W. Oliver; *Virginia Polytechnic Institute.*

Nearing completion at V. P. I. is a ninety degree magnetic analyzer which is to be used in conjunction with the V. P. I. electrostatic accelerator to analyze the accelerator beam, to aid in focusing the beam, and to serve as part of the beam energy measuring system and as a part of the beam energy control system. The magnet is the double-focusing, non-uniform field type designed to deflect a four MEV deuteron beam in a sixteen inch radius. Power for the magnet is supplied by a 6.5 kilowatt amplidyne controlled motor-generator set.

9. VOLTAGE CONTROL OF THE V. P. I. ELECTROSTATIC ACCELERATOR.

George L. Ball; *Virginia Polytechnic Institute.*

Under construction in the Department of Physics at Virginia Polytechnic Institute is a voltage control system for the nuclear accelerator which utilizes corona feedback. An aluminum slit box using tantalum slits collimates the particle beam and analyzes it according to energy. The signal received from the slit jaws is electronically amplified and fed to a corona discharge system inside the tank of the accelerator. The accelera-

tor electrode voltage is stabilized by an automatic change in the corona current when fluctuations occur in the beam energy.

10. SOME REMARKS ON THE DIAGONALIZATION OF MATRICES IN QUANTUM MECHANICS.

S. Olanoff; *Virginia Polytechnic Institute.*

The eigenvalue problem is considered and three avenues of approach are reviewed: the solution of quantum mechanical operator equations (such as the Schrodinger equation); the matrix method that leads to the secular equation and its solution; and the evaluation of the eigenvalues directly from the diagonal form of the operator matrix. It is pointed out that the direct evaluation of the eigenvalues from the diagonal form of the operator matrix is a relatively cumbersome procedure. Thus the real value of diagonalizing the matrix does not lie in its direct use for finding the eigenvalues. In the view of the author, this point should be made explicitly in the instruction of graduate students who are encountering the matrix formulation of quantum mechanics for the first time. The value of the diagonalization procedure for quantum mechanics is then discussed.

11. THE DISTRIBUTION OF IONIZATION ENERGY LOSSES OF MU MESONS IN ARGON.

T. E. Gilmer, Jr.[6], Robert Mace, E. D. Palmatier; *University of North Carolina.*

Studies of the ionization energy losses of relativistic cosmic ray mesons have been made using a specially constructed proportional counter with argon gas at pressures up to 80 atmospheres. Standard Geiger counter telescope techniques were used to restrict the meson path length and to define the meson energy groups. The pulses produced by individual mesons were amplified and analyzed on a forty-channel pulse-height analyzer of special design. The distribution of the pulses was observed to become narrower with increasing pressure in qualitative agreement with theory. This variation of width with pressure is compared with the theories of Landau, Blunck and Leisegang, and Moyal. It is found that the experimental widths fall in between the values predicted by the last two theories.

12. THE PREPARATION AND STRANGE BEHAVIOR OF PSEUDOMONOCRYSTALS OF ALPHA-TITANIUM.

Francis J. Denise and Henry Leidheiser, Jr.; *Virginia Institute For Scientific Research.*

Commercially pure titanium rods, 1/2" in diameter and 2" long, were

[5]R. J. Blin-Stowle, Proc. Phys. Soc. 65A, 949 (1952).

[6]Now at Experiment Incorporated.

wrapped in foil and sealed in evacuated Vycor tubes. When such rods were cycled between 850° and 1200°C. or between room temperature and 1200°C., large crystals of the beta-phase were formed at the high temperature. On cooling through the transition temperature at 880°C. the high-temperature crystal recrystallized to a very highly oriented assembly of small crystals of the low-temperature, alpha phase. Since the orientation was so high and continued to the boundaries of the original high-temperature crystal the term "pseudomonocrystal" is warranted. Heating a pseudocrystal in an evacuated Vycor tube at 850°C. for several days resulted in a great change in shape of the cross section, which change in shape was discontinuous at the boundary of another pseudocrystal. One type of commercial titanium became severly distorted when cycled between 860° and 1200°C. Metallographic and X-ray studies were made of the pseudocrystals.

13. TIME OF FLIGHT APPARATUS FOR HIGH ENERGY NEUTRONS.

P. J. Dolan, P. J. Kenny and H. A. Fincher; *University of Virginia.*

The apparatus described herein was designed for use in measurements of angular distributions of scattered neutrons. 15.2 Mev neutrons obtained from the $H^3(d,n)He^4$ reaction were used. A one million volt Van der Graaff generator was utilized to accelerate the deutrons. Collimation was performed electronically by counting coincidences between neutrons and the recoil alpha particles which were physically collimated. This avoided the high gamma background introduced by mechanical collimation. The counters were plastic scintillation crystals attached to model 6342 photomultipliers. One output of each of these went to a fast coincidence circuit, and a second output from each counter went through a pulse height discriminating device and then to a slow triple coincidence circuit. The output of the fast coincidence circuit furnished the third input to the triple coincidence circuit. Thus, the scaler, which counted the output of the triple coincidence circuit registered a count only when events occurred in both counters within a short time of each other and which caused pulses of the desired size. Collimated beams of neutrons about 12° wide were obtained. This width was a function of the counter size, and could have been made smaller if desired. Times of light were measured over paths of 15 cm. and 30 cm. with an accuracy of about 5%. These times amounted to 3×10^{-9} and 6×10^{-9} sec. respectively.

14. STANDARD CELL FOR STUDENT POTENTIOMETER.

F. L. Robeson and J. F. Ryman; *Virginia Polytechnic Institute.*

The mallory mercury-zinc dry cell (RM-1000), widely used as the "A" battery in hearing aids, has been found very satisfactory as the

[9] Now at Experiment Incorporated.

standard cell for students beginning measurements with the potentiometer. In each of four laboratories, a single cell of this type has been used without replacement for three years. During that time the greatest change of emf was from 1.3554 to 1.3392 volts. The temperature coefficient between −1°C. and +30°C. is 0.0001 per 1°C.

15. ELASTIC SCATTERING OF 14 MEV NEUTRONS.

Patrick J. Kenny, Herbert A. Fincher, Philip J. Dolan; *University of Virginia.*

In order to study the applicability of the Fesbach, Porter, Weisskopf (Phys. Rev. 96, 448 (1954) "cloudy crystal ball" model of the nucleus at intermediate energies, the scattering of 15-Mev neutrons by various targets was undertaken. This energy was chosen, because it is high enough so that compound elastic scattering can be ignored and the experimental results more easily compared with the predictions of the theory.

Utilizing the University of Virginia Van der Graaf electrostatic accelerator as a source of accelerated deuterons, neuterons were produced in the T(d,n)α reaction. "Electronic collimation" of the beam of neutrons was secured by counting only neutrons in coincidence with α's in an arbitrarily chosen direction. The neutron beam so defined was then scattered by a target, and the scattered neutrons were counted by a neutron detector whose bias was set to reject those neutrons inelastically scattered. Gamma rays from inelastic neutron scattering in the target were rejected because of their shorter flight time, whereas background neutrons scattered by the walls were rejected because of their longer flight time.

The data obtained for aluminum and lead scatters have been compared with the original optical model and a few of its subsequent modifications.

16. POSITRON ANNIHILATION IN LIQUIDS AND SOLIDS.

S. Berko; *University of Virginia.*

17. THE EFFECTS OF TEMPERATURE AND PHASE CHANGE UPON POSITRON ANNIHILATION.

Hugh S. Landes, S. Berko, and Artley J. Zuchelli; *University of Virginia.*

Delayed coincidence measurements have yielded an anomalous lifetime $(2.35 \pm 2) \times 10^{-9}$ sec., for positrons annihilating directly in liquid helium. No anomalous or long lived component was observed for

positron lifetimes in liquid nitrogen, only a short lived component of $(3.02 \pm .3)10^{-10}$ sec.

The observed lifetimes for positrons annihilating in Teflon at liquid helium and liquid nitrogen temperatures suggest a deviation from linearity for the functional relation between temperature and positron lifetimes in Teflon.

The effect of a phase change upon positron behavior was determined by observing the lifetimes for positrons annihilating in the organic crystal, naphthelene, throughout the temperature range from 25°C. to 100°C. The anomalous lifetime was found to increase about the melting point of 80.2°C. and to reach a value 2½ times its room temperature lifetime. Furthermore, the number of positrons annihilating with the anomalous lifetime was seen to triple upon passing from the solid phase to the liquid phase. These data suggest a strong correlation between positron behavior and disorder of the crystal, i. e., the capture cross section for positrons annihilating with the anomalous lifetime increases with the disorder. On the other hand, the triplet to singlet conversion rate decreases with disorder, thereby giving an increase in lifetime.

18. CONCERNING THE LIQUEFACTION OF HELIUM.

L. G. Hoxton; *University of Virginia.*

In a program of low temperature research the production of the temperatures desired and the experimental researches dependent thereon are often conveniently considered as two separate undertakings. This paper is limited to the former undertaking. The Department of Physics in the University of Virginia has been operating a Collins plant for liquefying helium (at 4.3°K.) for the last three years. Since apparently at the present time there is no similar plant in any other academic institution in Virginia, it is thought that a brief account of experiences with it and of accessories made for it would be of interest locally even if not in the realm of discovery.

19. TEMPERATURE EFFECT IN G-M COUNTERS.

Addison D. Campbell; *University of Richmond.*

The effect of temperature change in the range from 0°C. to 80°C. on argon-alcohol filled G-M counters was investigated. For a counter having a good plateau characteristic at room temperature, no effect was noted from 2°C. (the condensation temperature of the alcohol vapor) to 80°C. At 0°C. the plateau of this counter disappeared. This effect may be attributed to the formation of semi-conducting paths between the electrodes through the condensed alcohol.

Other counters having poorer plateau characteristics exhibited temperature effects at temperatures as high as 10°C. This is believed to be due to air contamination in the counters.

20. INSTRUMENTATION PROBLEMS IN UNDERWATER EXPLOSION TESTS.

M. E. Cruser, Jr.; *U. E. R. D., Norfolk Naval Shipyard.*

A general description of a program of instrumentation for underwater explosion tests against structures is outlined. Various gauges and recording methods are described, and problems in obtaining faithful records are discussed.

21. TENSILE STRENGTH OF LIQUID HELIUM[7].

J. W. Beams; *University of Virginia.*

The tensile strength of liquid helium has been measured by a centrifugal method similar in principal to that used by L. J. Briggs[8] in his classical experiments on the tensile strengths of liquids near room temperature.

Preliminary results give the tensile strength of liquid helium between 0.3 and 0.5 atmospheres. Below the Lambda point the tensile strength also has been measured by a piston and cylinder method. The values obtained are in essential agreement with those found by the centrifugal method.

22. MECHANICAL STRENGTH OF THIN SILVER FILMS[9].

M. M. Jones, Jr., S. Martinez and A. Stamper; *University of Virginia.*

The mechanical strength of thin silver films varying in thickness from 4×10^{-6} cm to 2×10^{-6} cm was tested by the bulge technique. The silver films were prepared by evaporating silver on a readily dissoluble plastic film mounted across one end of a small tubular cylinder. After the plastic was dissolved, leaving only the silver film, the cylinder was mounted on a nozzle attached to the movable stage of a microscope. Air pressure was applied until the film ruptured. From the pressure and deflection reading the tensile strength of the silver film could be calculated using the equation derived from L. N. Kachanow.

The results of the experiment showed that the average tensile strength gradually increased as the film thickness decreased with ceratin films showing a marked increase in tensile strength.

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[7] Supported by Office Ordnance Research, U. S. Army and Navy Bu. Ord.

[8] L. J. Briggs, J. Appl. Phys. 21, 721, (1950).

[9] Supported by OOR.

23. THE MAGNETIC BALANCE.

C. W. Hulbert and M. G. Sheffield; *University of Virginia.*

The change in position of a small magnetically supported sphere as the space around it was evacuated of gas was first noted by Beams[1]. In subsequent work, it has been found that a change in mass of 10^{-9} grams can be detected in a sphere weighing 175 micrograms[2] and that a change of 10^{-11} grams can be detected in a sphere weighing 2 micrograms[3]. Besides the buoyancy effect in gases, absorption effects were also found. The magnetic balance used to obtain the results above is the usual type of magnetic support circuit except that the position signal is obtained from light reflected from the sphere into a photomultiplier instead of the usual tuned grid tuned plate oscillator detector.

A modification of this balance is being used at the present time to study the properties of liquids. Sucrose solutions (water as a solvent) were chosen for the preliminary study of liquids because of the linearity between density and concentration. Adsorption effects are found here also, and preliminary results show that metallic surfaces adsorb a large amount of sucrose. Thus far coating with paraffin has been the only method for reducing the adsorption an appreciable amount.

24. TENSILE STRENGTH OF THIN METALLIC FILMS AT LIQUID NITROGEN TEMPERATURE.

P. B. Price, Jr.; *University of Virginia.*

Thin films of silver are electrodeposited on the surfaces of small, highly polished cylindrical rotors which have been specially treated to reduce adhesion. The rotor is supported magnetically in a vacuum, surrounded by a bath of liquid nitrogen, and accelerated synchronously by means of a rotating magnetic field until the film bursts and is thrown off. From a knowledge of the rotational speed of the rotor at the time of film failure, the tensile strength of the film can be determnied, using the relation $T = \rho\, w^2 R^2 - \frac{AR}{h}$

T=tensile strength
ρ=density of film
w=angular velocity at time of failure
R=radius of rotor
A=adhesive force per unit area
h=film thickness

For films thicker than about 6×10^{-5} cm., the strength is about that of bulk silver at room temperature. Thinner films exhibit increasing tensile strength which is explained on the basis of dislocation theory.

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[1] Beams, J. W., Rev. Sci. Instr., 21, 182 (1950)

[2] Lotz, W. E., "Magnetic Balance," Dissertation in Physics; University of Virginia (1953)

[3] Montague, R. M., "Gaseous Adsorption Measurements Using the Magnetic Balance" Thesis in Physics, University of Virginia (1955).

25. THE COMPRESSION OF CONDENSED GASES TO 20,000 KG/cm² AT LOW TEMPERATURE.

John W. Stewart; *University of Virginia.*

The previously reported[10] piston displacement technique for measuring compressibilities of solidified gases at low temperature has been carried up to pressures of 20,000 kg/cm², and has been extended to include solid helium. For helium at 4°K., measurements have been made between 2,000 and 20,000 kg/cm², and the results correlated with the molar volumes at pressures below 2,000 kg/cm² which were obtained thermally by Dugdale and Simon[11]. Values of the molar volume and instantaneous compressibility at 4°K. follow:

Pressure	Molar Volume	$-\frac{1}{v}\left(\frac{\partial v}{\partial p}\right)_T$
kg/cm²	cm³/mole	cm²/kg
143	17.1	93 x 10^{-5}
2,000	10.7	11
4,000	9.30	5.5
8,000	7.93	3.0
12,000	7.20	1.9
16,000	6.70	1.4
20,000	6.41	1.2

Results from other solidified gases at 4°K. and higher temperatures will also be presented.

26. THE DETERMINATION OF MOLECULAR WEIGHTS BY THE EQUILIBRIUM ULTRACENTRIFUGE METHOD.

Kenneth D. Williams; *University of Virginia.*

The equipment consists primarily of a 9 pound steel rotor, spinning at speeds of 100-300 revolutions per second in an evacuated chamber. It has been found that with a vacuum approximately 10^{-5} mm, Hg., the deceleration of the rotor is only about 1 r. p. s. in 10-12 hours.

A dilute solution of the sample is put in a sector-shaped cell contained in the rotor. The rotor is accelerated by means of an air turbine and then allowed to coast until the rate of sedimentation and the rate of diffusion of the molecules are balanced, thus establishing a condition of equilibrium.

Measurements of the concentration distribution within the cell are made from photographs (spectroscopic plates) of a changing interference

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[10] Physical Review, 97, 578 (1955).

[11] Proc. Royal Acad., A218, 291 (1953).

pattern produced by the refractive index dependence on concentration. The molecular weight is calculated by use of the formula[12].

$$M = 2RT \ln (C_2/C_1) / (1-\overline{V}\rho)\omega^2 (x_2^2 - x_1^2)$$

where R is the gas content, T the absolute temperature, C_2 and C_1 the concentrations at the radial distance x_2 and x_1 respectively, ω the angular velocity, $\overline{V}$ the partial specific volume of the solute, and ρ the density of the solution.

27. SOME METHODS OF MAKING THIN FILM WINDOWS FOR ELECTRONS.

W. Kent Ford, Jr.; *University of Virginia.*

Various methods of making thin metallic films have been tried in an attempt to make windows for an image-intensifying device to be used for astronomical purposes. A thin film window in an image tube serves to prevent contaminating vapors from a photographic plate from reaching a cesium photocathode and destroying its sensitivity. To serve this purpose the thin film must be free of pinholes, thin enough to pass 10kv electrons with negligible scattering, and sufficiently strong to support its own weight over an aperture of 1 cm. or larger. In addition, the film must withstand a baking out process at 300°C. in the evacuation of the image tube.

The general approach has been to evaporate aluminum onto an organic backing such as collodion or Zapon. At first, attempts were made to remove this backing material by using a solvent, or by baking in vacuum until the backing decomposed. Films made in this way were unsatisfactory because of the difficulty of removing the backing and because such films were very fragile and had pinholes.

Stronger films were made by using a backing which remained after baking. It was found that films evaporated onto Formvar (polyvinyl formal) would withstand the baking out, but it was difficult to produce large uniform Formvar films. Recently, the following method has been used with considerable success: A large Zapon film is made in the conventional way by placing a drop of Zapon on a clean surface of water and lifting the film when it has hardened. Then Formvar dissolved in chloroform is allowed to run over the surface of the fresh Zapon film. After the excess Formvar solution has drained off and the film hardened, the aluminum is evaporated onto the Formvar surface. The Zaphon can then be removed by using amyl acetate as a solvent, leaving the Formvar backing of the evaporated metallic film intact. Films made in this way have considerable strength, are generally free of pinholes, have thicknesses less than 0.05 mg./cm, and withstand baking out at 400°C. (This work was supported by the Carnegie Institution of Washington.)

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[12] Svedberg The K. O. Pedersen, "The Ultracentrifuge" (Oxford Press, 1940).

28. AN INTERESTING L-C-R CIRCUIT AS A TEST PROBLEM.

Addison D. Campbell; *University of Richmond.*

An interesting d. c. circuit containing inductance, capacitance, and resistance was discussed and its value as an exercise for students of electricity at the undergraduate level was pointed out.

29 PARTICLE DISTRIBUTION FROM A THIN SOURCE IN CONTACT WITH A COLLIMATOR[18].

Glenn H. Miller; *Ordnance Research Laboratory, University of Virginia.*

Calculations have been made on various quantitites associated with a thin particle source in contact with a collimator consisting of a flat plate with cylindrical holes. Expressions have been obtained for the distribution in angle for the emitted particles, the track length distribution in the source, and the total counting rate for any maximum angle. The total counting rate falls off very rapidly as the collimation is made more severe. It is concluded that the use of a collimator is not generally advisable, unless it is necessary to restrict the particles to a small angular spread. For such cases the expressions obtained make possible a rapid calculation of such quantities as the source thickness necessary for a given counting rate and the resulting distribution in energy loss in the course.

30. STATISTICAL RELATIONS BETWEEN GALACTIC ORBITAL ELEMENTS OF RED DWARF STARS.

E. R. Dyer, Jr.; *Leander McCormick Observatory, University of Virginia.*

Space velocities with respect to the sun have been computed from proper motions, parallaxes, and radial velocities for the first 305 red dwarfs discovered in the McCormick spectral survey. The galatocentric orbital elements a (semi-major axis), e (eccentricity) and i (inclination to the galactic plane) were calculated under the following well justified assumptions: (a) the motions in our neighborhood around the massive galactic center 8000 parsecs away are nearly Keplerian; (b) the point of maximum density in velocity space is identified with the circular velocity of 200 km/sec.

Preliminary plots show varying degrees of correlation between the elements in the following senses: (A) Orbits with a different from 8000 parsecs have for obvious reasons correspondingly large e; (B) The dispersion in i increases with increasing e; (C) The dispersion in i for orbits in the range $a = 7$ to 9 kiloparsecs is considerably smaller than outside

[18] This work was done at the Ames Laboratory of the U. S. Atomic Energy Commission at Iowa College while the author was associated with that institution.

this range; this is possibly a correlation compounded from (A) and (B).

This situation is similar to that prevailing among bodies in the solar system. It may reflect primordial conditions in the Galaxy, where stars (or proto-stars) with low inclinations would undergo more extensive momentum exchange with the surrounding material and would thus tend to have large eccentricities reduced.

31. A PRESSURE REGULATION FOR A LOW-PRESSURE CONTINUOUS FLOW IONIZATION CHAMBER[14].

Ralph A. Lowry, John E. Osher[15], and Glenn H. Miller; *Ordnance Research Laboratory, University of Virginia.*

A description is given of an automatic pressure-regulating device for a continuous-flow ionization chamber operated in the pressure range of 1 to 10 mm. Hg. The pressure monitor consisted of an oil manometer, a light source, and two phototubes arranged whereby any small change in pressure gave rise to a corresponding electrical signal. This signal was used to control the power to a thermal gas flow valve. The regulator was capable of maintaining the pressure constant to within 0.03 mm. Hg. for a period of at least 24 hours.

32. DEFINING FUNCTIONS.

Robert C. Yates; *College of William and Mary.*

For many reasons it seems important to define elementary functions properly before quitting a first course in Calculus. For example, a geometric treatment of the continuity of the sine function is wholly unsatisfactory; the calculation of the logarithm of a number through its customary definition is impossible except by an uncontrollable approximation.

There are various ways by which the elementary transcendental functions may be satisfactorily defined. A choice and popular means is via a definite intergral. A useful means, but somewhat less neat, is through a differential equation with conditions imposed on the function and its derivatives. By far the most direct means, however, is through the medium of power series. It is through such series that the logarithm, the experimental, the trigonometric and inverse trigonometric functions are defined.

Assuming that the processes of addition, multiplication, differentiation, and integration are applicable, all properties of these functions are established. Points of particular interest are the periodicity property of the trigonometric functions derived directly from their defining series, and the calculation with controllable accuracy of all function values.

[14] This work was done at the Ames Laboratory, of the U. S. Atomic Energy Commission at Iowa State College while the authors were associated with that institution.

[15] Present Address: University of California, Berkley, California.

33. ASTROMETRIC INVESTIGATIONS ON A STAR ASSOCIATION IN THE CONSTELLATION OF CYGNUS.

Heinrich K. Eichhorn; *Leander McCormick Observatory, University of Virginia.*

Recently, L. Muench and W. W. Morgan[16] pointed out a group of OB stars around BD + 40°4225. These stars are about 9^m to 10^m but from heavy reddening the total absorption is estimated about 5^m. Measurable proper motions might be expected, but only if extreme care is used in the reductions. A subsequent investigation of the field of the McCormick telescope[17] has shown that this instrument has a very noticeable coma and optical distortion, but that its accuracy compares otherwise (m. e. of one exposure $0^{\prime\prime}.06$) very favorably with that of similar instruments[18].

For the first epoch only the AC Helsingfors positions were available. To utilize the full inherent accuracy of these positions they were also investigated for coma. The findings of another investigator[19] were confirmed.

When the proper motions of this association have been measured accurately, we expect to confirm the expansion of the system.

34. SPECTRAL CLASSIFICATION OF STARS IN THE AGK2 ZONES.

A. G. A. Balz, Jr., (Introduced by A. N. Vyssotsky); *Leander McCormick Observatory, University of Virginia.*

Bergedorf Observatory in Hamburg (Germany) is engaged in a determination of proper motions of some 180,000 faint stars in the northern hemisphere. In order to make these motions statistically significant, it is important to have spectral classifications of these stars. For some 120,000 stars, spectra are available in publications of other observatories. The McCormick Observatory undertook to classify the remaining 60,000. A preliminary comparison of our classification with those of Bergedorf and Crimea (U.S.S.R.) shows that our accidental errors and systematic differences are small. This work has been supported by the National Science Foundation.

35. THE ASTROMETRIC ORBIT OF CHI DRACONIS 1900.0: R.A. = $18°22^m.9$ DECL. = + 72°41′).

H. L. Alden, W. E. Mitchell, Jr., and V. Osvalds; *Leander McCormick Observatory, University of Virginia.*

Chi Draconis is a spectroscopic and an unresolved astrometric binary.

[16] L. Muench and W. W. Morgan, Ap. J. 118, 161, 1953.
[17] H. K. Eichhorn, A. J. 61, 3, 1956.
[18] W. Dieckvoss, A. N. 282, 25, 1955.
[19] H. O. Gronstrand, Acta Soc. Scient. Fenn, Nov. Ser. A, Tom II No. 7.

Its visual magnitude is 3.7, spectral type dF5. The periodic variation in its radial velocity, indicating duplicity, was discovered by W. H. Wright in 1898. The large spectroscopic orbit suggested that an astrometric orbit might be derived also. There are two series of plates taken with the 26-inch visual refractor at the Leander McCormick Observatory. The first series, discussed by Alden in 1936, revealed further evidence of the duplicity of the system and gave a set of orbital elements. However, that series was taken in the early days of the astrometric photography and naturally was not as accurate as is possible today. On his return to the McCormick Observatory, Alden began an extensive second series. During the interval April 1946-August 1952, 92 plates were obtained covering 8 revolutions. The measurement of these plates yields a more reliable astrometric orbit in good agreement with the spectroscopic results. The period P = 280.53 days and the eccentricity of orbit e = 0.45 have been accepted from the latter and used throughout this work. The results are:

Semi major axis	$a = 0''.051 = 0.357$ Astr. Units
Inclination of orbit	$i = 54°$
Parallax, absolute	$\pi = +0''.143$
Annual proper motion:	
in R.A.	$\mu\alpha = +0''.505$
in Decl.	$\mu\delta = -0.392$
total	$\mu = 0''.64$ in 128°

36. CERTAIN PROPERTIES OF HYPER-CUBES, REGULAR HYPER-TETRAHEDRONS AND HYPER-SPHERES.

Herta T. Freitag, *Hollins College;* Arthur H. Freitag, *Jefferson Sr. H. S., Roanoke, Virginia.*

The above listed hyper-solids are constructed by the usual inductive procedure. The three continuities are: (1) point, line-segment, square, cube, tesseract . . . hypercube of n dimensions, (2) point, line-segment, equilateral triangle, regular tetrahedron, regular simplex . . . . regular hypertetrahedron of n dimensions; (3) point extremities of a line segment, circle, sphere . . . . hyper-sphere of n dimensions. The principles employed for the space-extension of these sequences are set forth in the paper.

Formulas for the number of boundary manifolds, the lengths of the hyper-heights, the lengths of the circum- and inscribed hyper-radii, and the hyper-volumes, are some of the properties developed in this work. In general, these formulas are established by mathmatical induction.

$$V_i^n = \binom{N+1}{i+1} \frac{a^i}{i!} \sqrt{\frac{i+1}{2^i}}$$

for the i-dimensional hyper-contents of n-dimensional regular hyper-tetra-

hedron is an example.

Well known relationships about certain properties of one-, two- and three-dimensional configurations in 3-dimensional Euclidean space emerge as special cases of a general law. For example, the above formula may be used for finding the perimeter, or area of any equilateral triangle as well as for the surface or volume of any tetrahedron.

37. A SIMFLIFIED DESIGN FOR A SPHERE GRINDER APPLICABLE TO VERY HARD MATERIALS.

Lilly R. Rappaport and William H. Dancy, Jr.[20], *Ordnance Research Laboratory, University of Virginia.*

In the past few years several devices have been described in the literature for grinding spheres from various materials. A study was made of these methods as applied to ferrites and other similar ceramics of extremely hard and brittle nature, and a design was evolved based on certain modifications of a unit due to Reggia and Stadler[21]. The instrument and its performance will be discussed in detail. It is currently used to grind spheres from various ferrites beginning with pieces of 1/4 inch diameter rods, but can be adapted to other sizes of stock. It is capable of high precision in sphericity, and the necessary grinding time is reasonably short.

38. THE EFFECT OF FILM THICKNESS ON THE ADHESION OF CHROMIUM FILMS ELECTRODEPOSITED ON STEEL[22].

William H. Dancy, Jr., and William M. Bland; *Ordnance Research Laboratory, University of Virginia.*

Small steel cylindrical rotors containing electrodeposited films of chromium have been suspended in a magnetic field and accelerated until the centrifugal forces acting on the plate cause the films to be torn from the base metal. The maximum stress on the adhesive band can be computed directly with a knowledge of the size of the rotor, the thickness and density of the rotor coating, and the speed of the rotor at failure. The stress is applied normally at the interface and involves no shear.

It has been generally known for some time that the thickness of the electrodeposited film had a definite influence on the adhesive force. With the new and improved testing method described above it has been possible to examine this effect in more detail. The results of this study will be presented as well as those obtained from an investigation of the effect of various pre-bath cleaning treatments on the adhesion.

[20] Supported by the Office of Naval Research.

[21] R. S. I. 26, 731 (1955).

[22] Supported by the U. S. Army Ordnance Corps.

39. TAYLOR INSTABILITIES IN HIGH SPEED SLIP FLOW[23].

Robert B. Nelson and A. R. Kuhlthau; *Ordnance Research Laboratory, University of Virginia.*

A high speed modification of a concentric cylinder viscosimeter with the inner cylinder rotating has been used to measure drag forces in low density air. Taylor [24] has shown theoretically that this geometry should produce inherent instabilities above a critical Reynolds Number, culminating in the formation of a series of vortices. This effect has been observed by several investigators using liquids and even gases at low speeds and relatively high densities.

The present work represents a detailed investigation of the predicted instability region under the conditions of low densities and extremely high cylinder speeds (surface speeds up to 1600 ft. per sec., Mach. No. = 1.47). The apparatus will be described briefly and experimental results presented. An evaluation of these data with regard to theory and other experimental work will be presented.

40. AN IMPROVED METHOD FOR THE ACCURATE DETERMINATION OF THE SURFACE TEMPERATURE OF RAPIDLY MOVING BODIES[25].

A. R. Kuhlthau and Lilly L. Rappaport; *Ordnance Research Laboratory, University of Virginia.*

A simple method for the measurement of the surface temperature of objects with which one is unable to make contact has been previously reported to the Academy[26]. This paper will describe various revisions and improvements made during the ensuing years which have markedly enhanced the accuracy and flexibility of the method.

The basic principles of operation remain essentially the same as before and may be outlined briefly as follows:

A lead sulfide cell is used as a detector for the infra red radiation from a similar body at known temperature. The radiation beam is modulated mechanically at 10 c. p. s., and the corresponding output of the detector is amplified by a tuned amplifier whose output may be calibrated to give the desired temperature directly.

41. A HIGH SPEED ELECTRONIC AMALOG MULTIPLIER[27].

Donald F. Nieman; *Ordnance Research Laboratory, University of Virginia.*

Work in progress at the Ordnance Research Laboratory of the Uni-

[23] Supported by Bureau of Ordnance, U. S. Navy under Contract NOrd 15875.
[24] C. I. Taylor, Phil. Trans. Roy. Soc. London, Ser. A, 223, 289-343 (1923).
[25] Supported by the Bureau of Ordnance, U. S. Navy under Contract NOrd 15875.
[26] Va. Jour. Sci. 4, Pg. 222, Sept. 1953.
[27] Supported by the Bureau of Ordnance, U. S. Navy under Contract NOrd 15875.

versity of Virginia required highly stable linear multipliers for use in real time simulation. Analog multipliers in conjunction with arbitrary function generators may be used to simulate the transfer characteristics of physical systems. In addition, these devices, in the communications sense, are excellent suppressed carrier linear modulators. After an extensive survey of the field one commercial multiplier[25] was chosen as offering, in principle, the most promise in fulfilling the laboratory's needs. This paper will describe work done in speeding up this unit and improving its stability and linearity characteristics.

BUSINESS MEETING

At its business meeting the membership elected the following new officers: *Chairman,* Melvin A. Pittman; *Secretary,* Edward E. Dyer, Jr.; *Section Editor,* Irving G. Foster.

[25] Manufactured by G. A. Philbrick Researches, Inc.

MINUTES OF THE SECTION OF BACTERIOLOGY (3)

A. L. ROSENSWEIG, *President*
WESLEY VOLK, *Vice-President*
BARBARA H. CAMINITA, *Secretary-Treasurer*
P. ARNE HANSEN, *Section Editor*

FRIDAY, MAY 11, 1956—MONTICELLO ROOM, JEFFERSON HOTSL

1. LACTOSE UREA IRON AGAR; A NEW DIFFERENTIAL MEDIUM FOR THE ISOLATION OF *Salmonella*.

John McNeill Sieburth; *Virginia Agricultural Experiment Station.*

Double and triple sugar iron agar slants which are widely used as differential tube media in the isolation of *Salmonella* fail to definitely separate species of *Proteus* from *Salmonella*. An autoclave sterilized lactose urea iron agar (LUI agar) has been developed which clearly separates coliforms as well as species of *Proteus* from other lactose non-fermenting organisms. Isolates having urease activity are detected in the original subculture from primary differential plate media, thereby obviating the customary use of a separate urease test medium. The basal medium of LUI agar consists of heart infusion agar (to support luxuriant growth) with the addition of lactose and urea as substrates, ferrous sulfate and sodium thiosulfate as a hydrogen sulfide indicator, mono- and di-hydrogen phosphates as a buffer, and phenol red as a pH indicator. Another application of LUI agar is as a primary plating medium for 'organ isolations'. Cultures can be read after 18 hours incubation but still retain their true reactions after 48 hours. Antigenicity of *Salmonella* species tested is maintained on this medium.

2. A PRELIMINARY REPORT ON A FREEZE-AGGLUTINATION TEST APPLIED TO A RESPIRATORY DISEASE OF CHICKENS.

C. H. Domermuth and E. P. Johnson (With the technical assistance of A. P. Tichelaar; *Virginia Agricultural Experiment Station.*

A new serological technique, freeze-agglutination (F-A), has been developed. This test appears to be effective in detecting PPLO infected or carrier birds. The procedure is briefly as follows: Serum which has been heated at 56 C. for 45 min. is delivered into capillary tubes and frozen. The Van Roekel PPLO strain, grown in Difco PPLO medium without crystal violet and concentrated to an optional density of 35

(Fisher electrophotometer, 650 A filter), is subsequently delivered into the tubes adjacent to the serum and the tubes are incubated horizontally for 5 min. at 37°C. The layered serum and antigen is then frozen horizontally, thawed in a horizontal position at 37°C., rotated to the vertical, slowly inverted, rotated ot an upright position and examined for presence or absence of clumping. Tubes containing no clumped material are regarded as negative and tubes containing clumped material are regarded as positive.

Data obtained as a result of comparing the F-A test with the hemagglutination-inhibition test and the macroscopic tube agglutination test indicate that the F-A test is relatively specific, sensitive and comparatively economical to run.

Preliminary evidence indicates that suitable modifications of the test will also be useful in other antigen-antibody complexes.

3. EXPERIMENTAL ENCEPHALOMYELITIS IN CATS.

P. Y. Paterson, E. D. Brand and M. I. Hansrote; *University of Virginia School of Medicine.*

Several mammalian species ranging in size from monkeys to mice develop encephalomyelitis following the injection of normal brain tissue emulsified in Freund's adjuvant. The pathogenesis of this condition is unknown. Studies in this laboratory have clearly shown cats to be susceptible to encephalomyelitis. Thus a new host has been provided for investigating the nature of this experimental form of tissue damage. Five normal cats received 3 ID or/and SQ injections of homologous brain in adjuvant at 3 week intervals. Each animal developed striking neurological signs 23 to 70 days after initial injection. These signs appeared abruptly and ranged from mild ataxia and weakness of the extremities through marked pupillary inequality to complete paralysis of the hind legs in individual animals. One of 2 cats examined histologically showed intense, patchy leptomeningitis and widely disseminated vascular inflammatory lesions within the brain and spinal cord. Serological studies revealed that 4 of the 5 animals developed a high titer circulating anti-brain antibody which fixed complement with alcoholic extracts of brain. Studies in progress are designed to extend these observations and define the role this new host may play in an attack upon the pathogenesis of experimental encephalomyelitis.

4. AN UNUSUAL COLONIAL FORMATION BY A STRAIN OF *Pseudomonas Aeruginosa.*

H. J. Melshimer; *Medical College of Virginia.*

The plating of a specimen of bronchial aspirate revealed two colony forms in abundance. One form was the typical flat, somewhat spread-

ing type of colony associated with *Pseudomonas;* the other was a large, dome-shaped, mucoid looking colony consisting of gram negative mobile rods that subsequently proved to be *Pseudomonas aeruginosa.* Although mucoid in appearance, this colony form does not string out on picking and does not emulsify easily. All attempts to demonstrate capsules failed. Upon subculturing the mucoid type colony in peptone broth and incubating at 37°C. a mixture of mucoid and typical Pseudomonas colonies is obtained. Cultivation of the mucoid form on peptone agar plates usually results exclusively in a mucoid colony subculture.

5. ANTIGENIC COMPONENTS OF *Lactobacillus lactis.*

Robert H. Miller and P. Arne Hansen; *Department of Bacteriology and the Livestock Sanitary Service Laboratory, University of Maryland.*

The antigenic components of a collection of 15 authentic strains of *Lactobacillus lactis* have been investigated. These appear to fall into 3 distinct categories on the basis of their reactivity in prepared monospecific sera. Various types have been demonstrated in this species, some of which contain major antigenic components that are different from those described by Williams and Orland. All *L. lactis* strains investigated contain the antigenic component K; so far this antigen has not been found in any other lactobacillus. Close agreement between the serology and the physiological characters of the species has been established.

6. FORM VARIATIONS AND ELECTROPHORESIS.

Shelley Harrell and P. Arne Hansen; *Live Stock Sanitary Service Laboratory, University of Maryland.*

A collection of 37 strains of *Salmonella pullorum* was classified as "variant," "intermediate," and "standard" by means of absorbed sera, specific for the somatic antigens: 12_2 or 12_3. A certain range of electrophoretic mobility was found to be characteristic for each variety. Using a Michaelis acetate-barbital buffer at pH 6.12 in a Northrop-Kunitz cell, "standard" strains showed a mobility (expressed in u/sec./volt/cm.) higher than 1.26; "variant" strains a mobility lower than 1.07; and "intermediate" ones occupied a position in between. The ammonium sulfate precipitation method by J. E. Williams was compared with the serological and the electrophoretic procedures. When the concentration of ammonium sulfate was 404 g. in one liter, complete agreement was obtained with the three methods.

Some of the strains studied were so unstable that it was mandatory to carry out the tests simultaneously.

7. SOME CAUSES OF POLLUTION IN SHELLFISH FROM HARVEST TO MARKETED PRODUCT.

R. Travis Hill; *Virginia State Department of Health, Whitestone, Virginia.*

BUSINESS MEETING

The following officers were elected to take office January 1, 1957: *President,* Wesley Volk, University of Virginia; *Vice-President,* Mrs. Barbara Caminita, Office of Naval Research, Washington, D. C.; *Secretary-Treasurer,* Miles Hench, Medical College of Virginia, Richmond.

MINUTES OF THE SECTION OF BIOLOGY (4)

J. L. McHUGH, *Chairman*

J. N. DENT, *Secretary*

ROBERT T. BRUMFIELD, *Section Editor*

FRIDAY, MAY 11, 1956—9:00 A. M.—EMPIRE ROOM "B"

1. LIVE TRAPPING AS A TECHNIQUE OF ESTIMATING RABBIT ABUNDANCE.

John B. Redd, Jr.; *Virginia Polytechnic Institute.*

The estimation of the rabbit population by the use of trap-mark-retrap formulae is questionable unless approximately 40 percent of the estimated population is handled. Due to the seasonal variation in the trapability of the rabbit, this technique appears to be of greatest use in mid-fall when a larger proportion of the rabbit population may be trapped. The trap-mark-retrap technique of estimating rabbit population on a monthly basis seems impractical on areas less than 100 acres due to inability to capture a sufficient number of animals.

The use of indices obtained from a live trapping program may be of value in comparing population densities on various areas. The indices which appear of greatest value for this purpose are (1) total number of individual rabbits captured per land use type and (2) trap nights per rabbit capture by land use type and (3) the total number of rabbits captured per 100 acres of land use type.

2. AN INVESTIGATION OF FACTORS AFFECTING THE BEAR KILL IN VIRGINIA.

Allen R. Stickley, Jr.; *Virginia Polytechnic Institute.*

Virginia's bear kill since 1949 has been quite erratic and over the past two years has declined steeply. Although weather and most conditions undoubtedly affect this kill, available information indicates that a decline in the bear population is perhaps the primary reason for the drop in black bear kill in Virginia in the past two years. Shortening the season and starting it later in the year are two possible corrective measures that may be expected to help maintain the bear population in the State in the face of the increasing hunting pressure. However, no definite conclusions should be drawn from the scanty data now available.

3. A STUDY OF SPORTSMEN'S MAGAZINE PREFERENCE AS A GUIDE TO EFFECTIVE CONSERVATION EDUCATION.

Robert H. Giles, Jr.; *Virginia Polytechnic Institute.*

Because of the great need for conservation of our natural resources, and the consequent need for more effective education of the public in wise resource use, a study was made of sportsmen's magazines to consider their possibilities as a conservation medium.

The study revealed that the most preferred magazines (in order) were: *Virginia Wildlife, Field and Stream, Sports Afield, Outdoor Life,* and *Hunting and Fishing.* The reasons for this preference were: "Keeps me informed", "Is enjoyable to read", "Gives me a wide variety", and "Is usually well written."

The four most preferred types of articles were, in order: True tales of hunting and fishing, short articles on animals, stories of places and places to go, and how-to-do-it articles.

These preferences and reasons led to the following conclusions and recommendations. An informal, non-educational approach is needed for teaching conservation to adults. This seems best done by well-written, *informative* articles, and by presenting conservation in those articles most preferred, and consequently most read by sportsmen, published in magazines with larger circulation.

4. THE ACANTHOCEPHALA OF MOUNTAIN LAKE MAMMALS

H. L. Holloway; *Roanoke College.*

The examination of 178 mammals belonging to six orders has revealed the presence of five species of the phylum Acanthocephala. Species and host list: *Centrorhynchus wardae* Holloway, 1956 from *Spilogale putorius* (Linnaeus); *Centrorhynchus* species (previously unrecognized) from *Procyon lotor lotor* (Linnaeus); *Moniliformis clarki* (Ward, 1917) from *Tamias striatus* and *Echinopardalis macrurae* (Meyer, 1931) from *Spilogale putorius.* Each report represents a new locality record. The species of the genus *Centrorhynchus* generally mature in birds but probably have a low degree of host specificity. The two species reported here were immature and only slightly advanced over encysted juveniles reported from frogs and snakes. Because the primary specific characters of the proboscis attain a stable state early in the ontogeny there would be no difficulty in recognizing the described species upon later encounter. *M. ingens* has previously been reported from Texas and Pennsylvania. *M. clarki* is widely distributed in North America. This is the first report of *E. macrurae* from the fauna of North America. The lack of gravid females in the "Allegheny Spotted Skunk" appears to indicate some degree of host-parasite incompatability.

5. THREE MODES OF REPRODUCTION WITHIN A SINGLE GENUS (HISTIOSTAMA, ANOETIDA, ACARINA.

Roscoe D. Hughes and Caroline Goode Jackson; *Medical College of Virginia.*

Preliminary observations on the mode of reproduction in eleven species of the genus Histiostoma show that one species is nonparthenogenetic, and ten species are arrhenotokous, the unfertilized eggs giving rise to males, and the fertilized eggs to females; and four species thelytokous, all eggs giving rise to females. This extreme degree of plasticity in the mode of reproduction, and by extension the mode of sex determination within a single genus, appears to be unique in the entire animal kingdom. The examples of thelytokous forms which apparently have arisen from arrhenotokous species in very recent times are given. In both species cited as examples, there are two "lines," or incipient sub-species. One "line" of each species is arrhenotokous and the other "line" thelytokous. For both species the females of the arrhenotokous "line" are almost indistinguishable from the females of the thelytokous "line." The possible significance of these preliminary observations are discussed.

6. TOXONOMIC AND MORPKOLOGICAL STUDIES ON THE GENUS *Acanthatrium* (TREMATODA LECITHODENDRIIDAE).

Thomas C. Cheng; *University of Virginia.*

The genus *Acanthatrium* in the Family Lecithodendriidae was erected by Faust (1919) to include all trematodes which possess the characteristics of the genus *Lecithodendrium* but in addition possess genital atria armed with spines. The generotype is *A. nycterides. Lecithodendrium sphaerula* (Looss, 1896), was included in the new genus. Up until the present only seven species, excluding the two already mentioned, have been described: *A. eptesici* Alicata, 1932, *A. molossidis* Martin, 1934, *A. oregonense* Macy, 1939, *A. ovatum* Yamaguti, 1940, *A. alicatai* Macy 1940, *A. microcanthum* Macy, 1940, and *A. pipistrelli* Macy, 1940.

Many of the above mentioned species have been identified from the small intestine of the bat, *Eptesicus f. fuscus.* In addition to these, two new species of the genus are being described.

Detailed studies have shown that the structure of the genital atrium and the morphology of the spines are the only reliable criteria for differentiating species. The reproductive organs and affiliated ducts were traced in whole mounts. Studies of sectioned material were made to determine the structure of these organs, previously poorly described.

7. A NEW SPECIES OF APHANOMYCES, AND ITS SIGNIFICANCE IN THE TAXONOMY OF THE WATER-MOLDS.

William W. Scott; *Virginia Polytechnic Institute.*

A new member of the Saprolegniaceae was described as the cause of a serious epidemic among populations of the planktonic cladoceran *Daphnia sp.* from Fraine Lake, Washtenaw County, Michigan. A description of the fungus and a discussion of the differences between it and related species of the genus were included. The significance of the behavior of the primary zoospores under abnormal environmental conditions was considered.

8. THE CHROMOSOME MORPHOLOGY AND SPECIATION OF SOME SPECIES IN THE GENUS AGLAONEMA.

Gertrude Earl; *The Blandy Experimental Farm, University of Virginia.*

The chromosome number and morphology of four species in the genus *Aglaonema* Schott are given. These are *Aglaonema Griffithii* Schott (*Aglaodorum Griffithii* Schott, *Aglaonema palustre* Teijsm, & Binn.), *A. commutatum* Schott, *A. simplex* Blume, and *A. Haenkii* Schott. The 2n numbers are 36, 120, 60, and 60, respectively.

Cytological evidence now seems to indicate that Engler's (1889) treatment of *Aglaonema Griffithii* as a separate genus *Aglaodorum Griffithii* is more correct. The chromosome number, chromosome morphology, and general morphology of this species is quite different from the other *Aglaonema* species examined.

It is doubtful that these genera should be included within either the tribe Philodendrae as proposed by Bentham and Hooker (1883) or the Richardieae as proposed by Hutchinson (1934). Both classifications place *Aglaonema* and *Aglaodorum*, which have the longest chromosomes yet described in the family Araceae, in tribes with genera which have some of the smallest chromosomes. It is suggested that Engler's classification is more in keeping with the cytological evidence. He places both genera in the tribe Aglaonemeae along with the genus *Dieffenbachia* Schott which also has very long chromosomes. *Aglaonema commutatum* with a 2n = 120 appears to be a higher polyploid species derived from some species with 2n=60.

9. A MONOGRAPH OF THE GENUS ROSA IN NORTH AMERICA. I. *Rosa acicularis.*

W. H. Lewis; *The Blandy Experimental Farm, University of Virginia.*

Rosa acicularis was described by John Lindley in his *Rosarum Mono-*

graphia (1820) from a specimen collected in Siberia. Since that time this species has been found distributed over all Northern Eurasia and North America south of the tree line, giving it the most extensive range of any species in the genus.

Not only are the Eurasian individuals octaploid (2n=56), but in contrast to the hexaploid individuals of North America (2n=42), but generally they possess longer peduncles with stalked glands, stems with bristles almost equal in length, leaves with 5 leaflets, eglandular below, and uniserrate, with those of North America characteristically have shorter, eglandular peduncles, stems with bristles unequal in length, and leaves with 7 leaflets, glandular below, and biserrate. From this evidence, the species is separable into two. The North American population is named *Rosa acicularis* Lindl. subsp. *Sayi* (Schw.) *comb. nov.* (= *R. Sayi* Schw., *R. bourgeauiana* Crep., *R. Engelmanni* Wats.,); the Eurasian population being known as *Rosa acicularis* Lindl. subsp. *acicularis.*

10. MORPHOLOGICAL VARIATION WITHIN A CLARKE COUNTY POPULATION OF *Ipomoea hederacae* (L.) JACQUIN.

Robert J. Knight; *The Blandy Experimental Farm, University of Virginia.*

With the long range view of studying possible evolutionary trends in *Ipomoea hederacea,* mass collection of this species was begun late in the summer of 1955. Herbarium specimens were made of 102 plants. Individuals in the population varied in leaf character and color of corolla. Rarely 5-lobed leaves are found, but the commonest type is 3-lobed. Corolla color may be a dilute blue or, more commonly, a deeper blue designated "wild". The genetic behavior of the above traits has not yet been determined. Percentages for the 1955 collection were as follows: *dilute color*—deeply lobed, 2.94; moderately lobed, 12.75; shallowly lobed, .98; unlobed, 2.94; *wild color*—deeply lobed, 22.55; moderately lobed, 56.86; shallowly lobed, .98. No wild color, unlobed plants were collected. All three lobed percentages can be added together under each corolla color type as follows: *wild*—lobed, 80.39; unlobed, 0.0; dilute—lobed, 16.67; unlobed, 2.94. Open-pollinated seeds were collected from selected individuals in the population for growing in the greenhouse. This is currently underway. The general similarity of the open-pollinated F_1 to the parental type makes an investigation of mode of pollination in this species desirable. *Ipomoea hederacea* occurs in tropical America as well as the U.S.A.

11. HEMOPHILIA IN THE HUMAN FEMALE, A REVIEW AND EVALUATION.

Murl C. Shawver; *Madison College.*

Reports of announcements from England that human female hemo-

philia had been discovered were made. The clinical histories and laboratory reports of three cases were reviewed. These reviews were based on the report of Dr. Clarence Morskey in the *Quarterly Journal of Medicine*, 1951. Morskey studied two daughters of a first cousin marriage in a family whose bleeding abnormalities had been studied since 1886. One case history was reviewed from Lancet, June, 1951 by Israels and others.

A report was made on the opinions of selected American hematologists, geneticists, and authors of leading college textbooks of genetics as to the validity of the studies made in England which had resulted in the claim that the first known human female hemophilics had been substantiated. It was reported that most of the authorities who responded to the inquiry indicated that the studies made in England on female hemophilics were valid. Several authors indicated that the recent studies in England regarding human hemophilia would be noted in forthcoming revisions of their books.

A brief review of recent advances in research on the nature of hemophilia and hemophilia-like diseases was made.

12. THE EFFECTS OF NUCLEIC ACIDS ON GROWTH OF TIMOTHY ROOTS.

Robert T. Brumfield; *Longwood College.*

The growth in length of timothy roots is essentially constant under controlled conditions for about 24-36 hours. Total root growth and the growth of individual cells can be accurately measured from photographs taken at 30 minute intervals. The timothy root is therefore an excellent object to test the effects of varied environmental conditions. The rate of growth of the roots was observed for a four-hour period; then they were treated with varied concentrations of RNA and RNAse. Preliminary results indicate that treatment with 0.01% RNA for 2 minutes completely inhibits growth. RNAse 0.005% (2 minutes) stimulated growth in two roots and depressed growth in two; 0.002% depressed growth in two.

13. PLANTS AS INDICATORS.

A. B. Massey; *Virginia Polytechnic Institute.*

Plants may be indicators of soil conditions by virtue of their ability to develop normally. Also they may be used as indicators of chemical elements in the soil by chemical analysis of their tissues.

Many plants absorb chemical elements present in the soil in minute amounts. These accumulate in the leaves and stems of some plants. By ashing the tissues of plant and making a chemical analysis of the ash, man can learn more as to the minor elements in the soil. Species

differ as to the amount of the difference minor elements which accumulate in their tissues. The species which accumulates a certain minor element, boron for example, can be used to determine the presence of that element in the soil.

14. INTRASPECIFIC ADAPTATION TO VARYING PHOTEPERIOD IN CERTAIN MEMBERS OF THE CONVOLVULACEAE.

Robert J. Knight; *The Blandy Experimental Farm, University of Virginia.*

Positive blooming response to a short day—or long dark period—has previously been reported by others for the sweetpotato, *Ipomoea Batatas* (McClellan, 1928), and for *I. Nil.* This is also implicit in Barker's (1917) recorded winter behavior of I. *purpurea* grown in greenhouses at Ithaca, N. Y. The latter two species grown at the Blandy Experimental Farm (39° N. Lat.) contain forms which vary in the time of onset of the flowering period. This is true of *Ipomoea hederacea,* and *I. tricolor,* and probably also of *Evolvulus alsinoides.* The time of bloom is apparently correlated with the latitude at which the parent plants grew, a form from a northern source invariably blooming under a longer day than the same species collected farther south. Forms of *I. Nil* long grown at high latitudes in European botanical gardens, flower at Blandy Farm under a long day (14 hours, 53 minutes) in July, while the same species collected wild near Ciudad Trujillo, Dominican Republic (18.9° N. Lat.), does not bloom in Virginia until early December (daylength 9 hours, 39 minutes.) Forms of wild *I. hederacea* originally from Blandy Farm, Brownsville, Texas (26° N. Lat.), and near Antigua, Morelos, Mexico (22.5°), began flowering at Blandy Farm under a day of 14 hours, 53 minutes; 13 hours, 4 minutes; and 12 hours, 47 minutes, respectively. This suggests a trend toward earlier bloom at higher latitudes in certain species of the Convolvulaceae.

15. THE MODIFICATION OF CELL SIZE IN TIMOTHY ROOTS BY ALPHA PARTICLES.

Donald E. Foard; *Longwood College.*

In a growing organ cell size may be modified by affecting any of the following factors: the frequency of cell division; the rate of cell expansion; the length of time the cell expands after its final division. The relationship between these factors may be observed directly in the surface cells of timothy roots, where it is possible to record photographically the division and elongation of individual cells. Irradiation of timothy roots by alpha particles of appropriate dosage results in abnormally long cells in the meristematic region (apical 300 μ), the maximum effect appearing 10-12 hours after exposure. That these greatly elongated cells are due to the inhibition of cell division and not to the stimula-

tion of cell elongation is evident since the rate of elongation is depressed during a 13 hour period after irradiation, and new cell walls fail to appear in the meristematic cells during this interval.

16. THE EFFECT OF PARTIAL HEPATECTOMY ON THE HEMATOLOGY AND SPLEEN SIZE OF THE GOLDEN HAMSTER.

W. L. Mengebier; *Madison College.*

Normal hematological values for the golden hamster were determined and compared to published results. After appropriate control values were secured, the left lateral lobes of the livers were excised and the hematology of these experimental animals was investigated at determined post-operative intervals. No significant changes in total R. B. C. or W. B. C. were found. Differential counts were not significantly changed nor was the hemoglobin concentration. Clotting times were significantly increased. The weight of spleen expressed as percentage of total body weight was significantly increased in experimental animals. Variations in the above results after treatment with thyroxin were discussed.

17. CYTOCHEMICAL OBSERVATIONS ON THE DIFFERENTIATION OF THE ANTERIOR PITUITARY GLAND OF THE RAT.

Jean C. Dofflemoyer; *University of Virginia.*

Cytochemical observations were made on the developing pituitary glands of young rats *in vitro* and *in vivo*. Pituitaries from animals five days old showed little cytological differentiation. At 25 days beta cells, delta cells, and acidophils were observed, but the acidophils were not as well differentiated as the other two cell types. At sixty days all three were present and well differentiated.

Pituitary glands from five day old rats grown *in vitro* exhibited only fibroblastic growth. In glands from 25 day old rats, delta cells, beta cells, and numerous fibroblasts were observed in tissue culture. Pituitary glands from 60 day old rats produced flourishing growths of beta and delta cells, acidophils and fibroblasts.

It is suggested that when the cells of the pituitary divide in tissue culture they undergo some de-differentiation with each division, regressing eventually to the status of fibroblasts.

It is concluded that the stage of development of the gland prior to its being put in tissue culture is probably an important factor in the degree of differentiation seen in the cells which arise from the cultured fragment.

18. CONJOINED TWINNING IN CRAYFISH.

Elizabeth M. Zipf; *University of Virginia.*

While pursuing a study of the embryonic development of the cray-

fish, *Cambarus longulus longulus* Girard, a pair of newly-hatched crayfish were discovered to be inseparately conjoined. The two animals were joined along the dorsal surface of the body, from the rostrum to the posterior margin of the carapace. Upon sectioning, it appears that the two share a common yolk mass as well as a common anterior blood sinus but each crayfish seems to have its full complement of appendages and internal organs. Since cleavage in the centrolecithal egg is superficial, the occurrence of conjoined twins is not common. It is postulated that two eggs passed down the oviduct in tandem, and were affixed to the pleopods in a common enveloping membrane. As the developing carapace of each animal progressed dorsally, the margins of one met the corresponding margin of the other and fused. The juxtaposition of the two yolk masses probably inhibited the usual dorsomesial growth of the fold.

19. THE CRAYFISHES OF THE LOWER FLINT-CHATTAHOOCHEE RIVER SYSTEM.

C. W. Hart and Horton H. Hobbs, Jr.; *Randolph-Macon College* and *University of Virginia*.

Twenty species and subspecies of crayfishes are known to inhabit the region of the lower Flint-Chattahoochee and Apalachicola rivers. Among the assemblage are representatives of four genera; *Cambarellus* and *Orconectes* are each represented by one species, the genus *Cambarus* by four, and the remaining 14 are members of the genus *Procambarus*.

Only two crayfishes, *P. rogersi rogersi* and *P. latipleurum* are endemic in this drainage system but the ranges of several of them have their eastern or western boundaries terminating here. Of particular interest is the highway provided by the river for two species that have reached Florida from the Piedmont Province.

Despite the absence of marked differences in elevation of the terrain, the diversity in soil type and aquatic habitats has provided barriers and highways in this region that has permitted the development of a rich crayfish fauna. Too, the diversity of habits of the members of this fauna has apparently contributed to its wealth. Some of the species are confined to streams, others to burrows in flatwoods or seepage areas, while still others are most abundant in temporary ponds or roadside ditches.

20. THE AGAR DIFFUSION TECHNIQUE AS APPLIED TO THE STUDY OF SEROLOGICAL RELATIONSHIPS OF CRAYFISHES.

Rose Mary Johnson; *University of Virginia*.

The right-angled double-diffusion gradient method of Elek (1949) was tested as a means of detecting serological homogeneity and heterogeneity among closely related crayfishes of the family Astacidae. Nine

species of the genus *Cambarus*, one species of *Procambarus*, three species of *Orconectes*, all members of the sub-family Cambarinae, and one species of *Astacus*, sub-family Astacinae, were used in the study.

The results of tests involving antisera of four species of *Cambarus* with sera of twelve species and sub-species are reported. The conclusions tend to support the current classification used in this group.

21. REACTIONS OF *Stenostomum virginianum* TO VITAL STAINING.

E. W. Pullen; *University of Virginia.*

Evidence obtained in experiments in which the rhabdocoel *Stenostomum virginianum* was vitally stained with Bismarck brown indicates that the rhabdites of the epidermal cells proper stain readily and that these vitally stained rhabdites are engulfed by the histiocytes of the collenchyma. The histiocytes apparently destroy the rhabdites by phagocytosis. Contrary to previous reports, the staining of the gut epithelium is merely the result of the vital stain entering the enteron and staining cellular components of the ciliated gastrodermal cells. Diminution of color in the epidermis, then, is the result of the loss of rhabdites to the histiocytes while diminution of color in the gastrodermis is by the digestive action of the gastrodermal cells.

22. STUDIES ON THE GASTROTRICHA WITH ESPECIAL REFERENCE TO *Polymerurus rhomboides* STOKES IN VIRGINIA.

C. E. Packard; *Randolph-Macon College, Ashland.*

Polymerurus rhomboides Stokes, a chaetonotid gastrotichan, is reported from Ashland, Virginia, with observations on its laboratory habitat, morphology, cultivation, and embryology. This (and other species) has been the subject of study by the author in Maine and elsewhere since 1935, relatively little attention having been given the group by investigators in this country. It is believed that this is the first official reporting upon these multicelluar, microscopic animals in the State, and the third time it (*Polymerurus rhomboides*) has been reported since its discovery by Stokes in New Jersey in 1887.

23. A CLARIFICATION OF THE SPECIES OF THE GENUS *Typhloplana*.

John G. Mahan; *Lynchburg College.*

In recent years only one species of *Typhloplana* has been recognized, *Typhloplana viridata*. At least two exist, the other being *Typhloplana minima*. This is proved by the presence of a special dorsal atrium in one which receives the penis, this structure being absent in the other. A new form of *Typhloplana viridata* which lacks the viviparous stage in the life cycle has been found and for this a sub-specific name *ovipara*, is proposed.

24. SOME MORPHOLOGICAL STUDIES ON RESISTANT AND NON-RESISTANT STRAINS OF THE GERMAN COCKROACH.

John G. Mahan and James McD. Grayson, *Lynchburg College* and *Virginia Polytechnic Institute.*

Measurements of total length, head width, pronotum width, and pronotum length were made on adult cockroaches of comparable age from DDT-resistant, chlordane-resistant, lindane-resistant, and non-resistant strains. Results have indicated a significant diminution in all measurements for the resistant strains.

BUSINESS MEETING

The following new officers were elected: *Chairman,* Jack B. Burke and *Secretary,* Harry L. Holloway.

MINUTES OF THE SECTION OF CHEMISTRY (5)

RICHARD M. IRBY, *Chairman*
MARY E. KAPP, *Secretary*
CARL J. LIKES, *Section Editor*

FRIDAY, MAY 13, 1956–9:00 A. M.–LIBRARY "A"

1. THE FLUORINATION OF CYANOGEN BROMIDE.

H. L. Craig, Jr., and E. R. Nixon; *Reynolds Metals Company* and *University of Pennsylvania.*

Cyanogen bromide was reacted with silver difluoride in an all-glass vacuum system. The volatile products were condensed in a trap cooled with liquid air. Some nitrogen gas, formed in the reaction, was removed by pumping on the system. The major product was hexafluoroazmethane. A relatively pure fraction of this material was collected by fractional distillation. Compounds found in the lower boiling fractions were: carbon tetrafluoride, carbonyl fluoride, trifluorobromomethane, hexafluoroethane, silcon tetrafluoride, carbon dioxide and trifluoronitrosomethane. The high boiling fractions contained considerable hexafluoroazomethane with some bistrifluoronitrosamine, bromine fluoride and two unidentified compounds. Product identification was made by molecular weight determination, chemical analysis, and by interpretation of ultraviolet, visible and infrared spectra.

The reaction is postulated to occur through the addition of the cyanide nitrogen to the silver atom and fluorination of the cyanide carbon. Upon further fluorination and substitution for the bromine atom, a trifluoromethyl nitrogen radical is formed. Decomposition of the trifluoromethyl nitrogen-silver complex accounts for the formation of the products. Oxygenated compounds result from oxygen contamination of the silver difluoride. Traces of silicon fluoride appear to result from a partial reaction of bromine fluoride with the glass of silicone stopcock grease.

2. DERIVATIVES OF CHELIDAMIC ACID.

D. G. Markees and G. W. Kidder; *Amherst College, Amherst Massachusetts.*

Chelidamic acid and some of its esters were converted for derivatives of 4-chlorodipicolinic acid, which in turn were used for the preparation of O-alkylchelidamates. The various interconversions of these compounds are reported. Free O-alylchelidamic acids were prepared and

compared with their N-alkyl isomers. The ultraviolet absorption spectra of these acids are presented and some of their reactions are described.

3. NEW AMINOPYRIDINES AND RELATED COMPOUNDS.

D. G. Markees and G. W. Kidder; *Amherst College, Amherst, Massachusetts.*

The Curtis Reaction was carried out with a number of substituted pyridinecarboxylic acids. Besides the expected amines, products of partial rearrangement and hydrolysis were isolated and identified.

Some of the compounds obtained are closely related to powerful plant growth regulators and were tested for such activity. The results of these tests are presented.

4. NEW ANALOGS OF GUANINE AND XANTHINE.

D. G. Markees and G. W. Kidder; *Amherst College, Amherst Massachusetts.*

The synthesis of several analogs of guanine and xanthine is reported. It was accomplished by preparing some new triaminopyridines and subsequent ring closure between amino groups in positions two and three. Ultraviolet and infrared spectra of some of the compounds are presented.

Intermediates used in these syntheses were new azo- and nitrosoderivatives of pyridine. Some of their reactions are described.

5. THE RATES OF THE ACID-CATALYZED REACTIONS OF AROMATIC ALDERHYDES WITH *n*-BUTYLAMINE.

George M. Santerre and Thomas I. Crowell; *University of Virigina.*

The rate of formation of the Schiff base from piperonal and *n*-butylamine, $ArCHO + BuNH_2 \longrightarrow ArCH{=}NBu + H_2O$ was measured in mechanical solution at 25°C. The solutions were buffered with acetic acid and of *n*-butylamine at the appropriate ionic strengths, the actual concentration of *n*-butylamine was calculated. The observed rate equation, checked at several pH values, was

$$\underline{k} = \underline{k}_o + \underline{k}_a [HOAc]$$

where k is the apparent second-order rate constant:

$$\text{rate} = \underline{k} [BuNH_2] [ArCHO].$$

The effect of structural changes in the aldehye upon $\underline{K}_a$ and $\underline{k}_o$ is discussed.

6. REACTIONS OF NITRYL CHLORIDE.

W. D. Goode, Jr., R. D. Whitaker, and J. H. Wise; *Washington and Lee University.*

A convenient method of preparing nitryl chloride will be described. An investigation of substitution reactions of organic molecules with this reagent has been undertaken. The observed reactivity of nitryl chloride was not so great as was expected from the postulated mechanism of the preparation reaction. Results of reactions with benzene and toluene, in the presence of acid or base or neither, have indicated that nitration predominates in acid media, while chlorination predominates in basic media.

The interpretation of these results required a difference in polarization of the nitryl chloride in the different media. The proposed mechanism was an interaction of the nitryl chloride with a Lewis acid or Lewis base to yield nitronium or chloronium ions as the attacking agent.

7. NUCLEAR SUBSTITUTED ANALOGS OF 3, 4-DIHYDROXYPHENYLALANINE.

Carl Kaiser and Alfred Burger; *University of Virginia.*

Substances closely related in chemical structure to an essential metabolite often antagonize the biological function of the metabolite. A series of nuclear substituted 3, 4-dihydroxyphenylalanines and 3,4-dimethoxyplenylalanines, closely related in chemical structure to DOPA, has been prepared. Studies of the metabolism of phenylalanine, an essential amino acid, indicate that DOPA may be an intermediate in the formation of the hormones, epinephrine and nor-epinephrine. Antagonists of DOPA have been sought with the objective of preventing the formation of these two hormones *in vivo*. The possible usefulness of such antimetabolities as chemotherapeutic agents will be discussed.

8. SYNTHESIS OF PURINE AND RIBOFURANOSYLPHONIC ACIDS AND RELATED COMPOUNDS.

Manfred E. Wolff and Alfred Burger; *University of Virginia.*

Previous work in this laboratory has resulted in the preparation of a number of 7-theophyllinylalkylphosphonic acids. The synthetic methods developed as a result of these studies are now being extended to the production of purine ribofuranosylphosphonic acids. The status of the latter problem and the potential usefulness of phosphonic acid analogs of nucleotides in the chemotherapy of cancer will be discussed

9. THE PREPARATION OF CHLORO SUBSTITUTED N, N, DIPHENYL BENZAMIDES.

James E. Worsham, Jr., and James W. Cook; *University of Richmond.*

Attempts to prepare a series of chloro substituted N. N. diphenyl

benzamides for an investigation of their dipole moments to benzene solution are described.

Several known methods were employed in addition to the thermal rearrangement of the pure N-phneylbenzinimo phenyl ethers. These imino ethers were prepared by treating benzanilide with phosphorus pentachloride yielding an imino chloride, followed by the reaction of this product with the phenoxide ion in absolute ethanol.

An interesting possibility is the existence of isomers of the monochlorodiphenyl benzamide. This is to be investigated by dipole moment studies of the benzamide obtained from N-*p*-chlorophenylbenzimino phenyl ether and from N-phenylbenzimino *p*-chlorophenyl ether.

10. A KINETIC STUDY OF THE B-GLUCOSIDASE-B-D-GLUCOSIDE SYSTEM.

H. L. Whidden; *Randolph-Macon Woman's College.*

Thermodynamic functions were calculated from kinetic data to aid in elucidating the mechanism of action of B-glucosidase on B-D-glucosides.

A detailed kinetic study, based on the theory of equilibrium-enzyme-substrate formation, was effected over a range of temperatures for the enzymatic hydrolysis of four phenyl B-D-glucosides. "Rohferment", the crude B-glucosidase content of sweet almonds, was the enzyme and the four glucose sybstrates were phenyl-, *p*-nitrophenyl-, *p*-aminophenyl-, and *p*-hydroxyphenyl-B-D-glucoside. The hydrolysis was carried out in acetate buffer (pH 4.5) in a constant temperature bath at 29°, 30°, and 40°C. The rate of hydrolysis was determined by measuring with a Beckman DU spectrophotometer the glucoside remaining unhydrolyzed at designated time intervals.

The kinetic data obtained was analyzed in such a way as to furnish thermodynamic data—heats of reaction and changes in entropy—for both the formation and the decomposition of the complex. Positive entropy changes for the formation of the complex indicate that the enzyme may form the complex by opening out its structure; negative entropy values for the decomposition of the complex may indicate that under those conditions the enzyme may resume its original structure and thus decrease its volume.

Thermodynamic data obtained by other investigators has suggested similar enzyme action for trypsin, pepsin, and urease on their respective substrates.

11. STEREOCHEMISTRY AND CONFORMATION IN CONJUGATED UNSATURATED KETONES AND ENOLS. ADDITION-ENOLIZATION.

Robert E. Lutz and Chi-Kang Dien; *University of Virginia.*

1, 1, 2-Triaroylethylenes have bene prepared through 3-aroyl-2, 5-

diarylfurans by nitric acid oxidations. They are reduced to the saturated triketones or to furans, and undergo typical addition-cyclizations to the chloro and actetoxy furans. In the additions of hydrogen halide and morpholine, the groups go to the two positions as shown by subsequent furanizations of the addition compounds and oxidations of the furans. Chlorinations and brominations have been studied. Bromination of the unsaturated triketone involves reduction of the 1-bromine of the dibromide and furanization.

The persistence and instability of metastable α-substituted β-diketones are attributed to steric effects. The existence of two stereoisomeric α-phenacyldibenzoylmethane enols has been demonstrated. One (*cis*, crystalline) was obtained by enolization of the triketone and gave a normal chelated copper derivative. The other (*trans*, oil) was obtained by conjugate reduction of tribenzoylethylene which followed a predicted stereochemical course, and gave a non-chelated complex copper salt involving four molecules of enol. Steric factors affecting the ease of furanization of the *trans* enol and its 3-bromo derivative are discussed. Reversible addition-enolization of tribenzoylethylene by alkoxide ion was demonstrated, and the effect of acid on competing ketonization and elimination is discussed. *Trans*-dibenzoylethylene is shown to undergo reversible base-catalyzed addition of alcohol under similar conditions.

New examples of *cis*-addition-furanization have been studied and the mechanism discussed.

12. UNSATURATED CYCLIC SULFONES; PYROLYSIS OF 3-BROMOMETHYL-2, 5-DIHYDROTHIOPHENE 1, 1-DIOXIDE.

Robert C. Krug and Teh Fu Yen; *Virginia Polytechnic Institute.*

The peroxide catalyzed reaction of 3-methyl-2, 5-dihydrothiophene 1, 1-dioxide with N-bromosuccinimide in chloroform grade 3-bromomethyl-2, 5-dihydrothiophene 1, 1-dioxide in 38 per cent yield. The pyrolysis of the latter compound under reduced pressure gave a bromodiene identified as 2-bromomethyl-1, 3-butadiene together with a second and unexpected compound which appeared to be a dibromoalkene. On the basis of certain chemical properites and the interpretation of the infrared spectrum, this dibromoalkene has been assigned the structure corresponding to 1, 4-dibromo-2-methyl-2-butene.

13. SOME EXPERIMENTS REGARDING THE ELBS REACTION.

Frank A. Vingiello and Walter W. Zajac, Jr.; *Virginia Polytechnic Institute.*

The Elbs reaction which involves the pyrolysis of diaryl ketones having a methyl substituent adjacent to the carbonyl group provides one of the simplest routes to the preparation of polynuclear hydrocarbons.

In an attempt to broaden Bradsher's aromatic cyclodehydration reaction [C. K. Bradsher, *J. Am. Chem. Soc.* 62, 486 (1940)] we undertook to study the cyclization of some 2-benzylphenyl naphthyl ketones. The first ketone studied was 2-benzylphenyl-1-naphthyl ketone (I). The cyclization required drastic conditions and the results were quite surprising. High temperature acid catalyzed cyclization gave 10-phenyl-1, 2-benzanthracene (III) and 9-(1-napthyl)-anthracene (II) in approximately equal quantities. Cyclization of the same ketone using alumina gave mainly 10-phenyl-1, 2-benzanthracene (III) with but a small amount of 9-(1-naphthyl)-anthracene (II). Compound II was expected as the normal product of the acid catalyzed cyclization of the ketone I according to all previous work; however, the presence of compound III was surprising indeed. The cyclization seems to have followed a path similar to an Elbs-type reaction. Such reactions were thought to occur only at higher temperatures and with no solvent or catalyst present. This led us to investigate the use of alumina to effect the Elbs-type cyclization of other structurally similar ketones.

The ultraviolet spectra of all new hydrocarbons will be presented.

14. THE APPARENT ROLE OF CYSTINE IN VARIOUS COMMERCIAL PROTEINS.

William R. Smithey, Jr.; *Virginia-Carolina Chemical Corporation.*

Cystine has long been recognized as an important constituent of the proteins in wool and hair. The classic researches of Milton Harris and his co-workers [Patterson, Geiger, Mizell, and Harris, *J. Res. Nat. Bur. Stds.*, 27, 89 (1941); Geiger, Kobayashi, and Harris, *ibid.*, 29, 381 (1942)] have led to a sound theoretical and practical understanding of the role of cystine in both wool and hair.

The proteins from corn and soybean are known to contain much less cystine than wool. The probable role of cystine has been studied through cystine analyses and chemical reactions and by comparison of properties of various fibers.

The conclusion reached is that cystine probably plays a minor role so far as the fiber forming properties of zein and soybean proteins are concerned.

15. THE BOHR THEORY OF ATOMIC HYDROGEN.

Eric Adelberger; *Washington-Lee High School, Arlington.*

16. GROWTH OF COPPER POWDER IN THE REACTION OF HYDROGEN AND OXYGEN ON A COPPER SINGLE CRYSTAL.

Robert E. Cunningham; *University of Virginia.*

Under some conditions the reaction of hydrogen and oxygen on a

copper surface leads to the formation of dendritic metal growths. It has been found that these growths occur only when an oxide film is present. In the absence of oxide films, powder already formed slowly disappears if reaction is continued, but not if the metal is simply heated in hydrogen.

17. THE ETCHING OF COPPER SINGLE CRYSTALS IN AQUEOUS SOLUTIONS.

G. Tyler Miller, Jr.; *University of Virginia.*

Etching of copper single crystals was shown to vary with crysatllographic face in $CuSO_4$-H_2SO_4 solutions. Studies also showed that the nature of the etch patterns formed varied with the acidity of the solution.

18. THE DEVELOPMENT OF ETCH PITS, SPIRALS, AND FACETS BY HEATING COPPER CRYSTALS TO HIGH TEMPERATURES IN HIGH VACUUM.

F. W. Young; *University of Virginia.*

In order to study the development of tech pits and facets on different crystal faces, single crystal spheres of copper were carefully polished, cleaned and heated by induction heating to temperatures near the melting point in vacua 5 x 10^{-6} mm. Hg. In one set of experiments copper was evaporated from the surface of the crystal and condensed on the cold wall of the vacuum vessel. Facets were formed parallel to the (111), (100), and (110) faces, and some etch pits were developed. On some crystals, spirals with large steps were developed around the (111) poles. In a second set of experiments the crystal was suspended in a copper cup which was heated with the crystal so as to approach equilibrium between crystal and vapor. Facets were also formed by this treatment, and a larger number of etch pits were formed in the surface. The number of etch pits per unit area varied with crystal face and with temperature of heating.

19. A HIGH VOLTAGE ELECTRON DIFFRACTION APPARATUS AND ITS APPLICATION TO THE STUDY OF METAL SURFACES.

Kenneth R. Lawless; *University of Virginia.*

Information on the structure of surfaces and surface films is obviously essential to an understanding of the surface properties of metal crystals. To supplement X-ray and microscope methods for studying this structure a high voltage electron diffraction apparatus has been designed and constructed. The diffraction unit operates at 40, 60, 80 and 100 KV, will accept either bulk specimens for reflection studies or stripped films for transmission studies, and the patterns may be recorded on film for a permanent record. Four major types of information have been obtained: 1. Crystal structure and chemical composition. 2. The degree of

perfection of the crystals. 3. The surface topography. 4. Orientation relationships between surface films and the metal substrate.

20. THE OXIDATION OF SINGLE CRYSTALS OF NICKEL.

Kenneth R. Lawless, Fred W. Young, and Allan T. Gwathmey; *University of Virginia.*

Previous studies have shown that the rates of oxidation of single crystals of copper, and the structure of the oxides formed thereon, vary markedly with the crystal face exposed at the surface. The purpose of the present paper is to present preliminary results of a study of the oxidation of large crystals of nickel. The presence of hydrogen in the nickel was found to have a striking influence on the rates of oxidation of the different faces, and reproducible results could be obtained only when the crystals were thoroughly outgassed and metal was evaporated from the surface at a temperature of approximately 1300°C. and a pressure of 1 x 10^{-7} mm. Hg. The relative order of the rates of oxidation of the different faces, using interference colors as an approximate measure of the thickness of the oxide film, and the structures of the oxide on the (100), (110), and (111) faces as determined by electron diffraction, will be given. Nuclei of oxide could be seen on the different faces with an optical microscope for crystals from which all hydrogen had been removed. No nuclei could be detected on crystals from which hydrogen had not been removed.

21. RADIOACTIVE TRACERS IN ELUCIDATING ANTIOXIDANT AND CORROSION INHIBITING MECHANISMS.

Donald R. Campbell and James W. Cole, Jr.; *University of Virginia.*

The unusual activity of phenothiazine and some of its derivatives as inhibitors for the autoxidation of high boiling fluids, such as di-(2-ethylhexyl) sebacate, has been attributed, at least in part, to the presence of oxygenated free-radicals of a semi-quinone type. The fate of these species cannot be determined because of the complex nature of the oxidation products of the system. Convenient techniques have been devised for following the behavior of additives as antioxidants and corrosion inhibitors when the additive contains a radioactive isotope. These substances have been synthesized: S^{35} phenothiazine; N-C^{14} methyl phenothiazine and N-methyl S^{35} phenothiazine. Their behavior at 200°C. has been followed when they were present in small quantities in the oxidation of di-(2-ethylhexyl) sebacate in the absence and presence of catalytically active metal surfaces. The results support the hypothesis that the intermediate oxygenated species undergo a further approximately first order reaction to precipitate sulfur containing substances.

22. The Preparation of Elemental Boron of High Purity.

Claude P. Talley, James C. Rahman, and Lloyd E. Line, Jr.; *Experiment Incorporated.*

Elemental boron of high purity has been prepared by the reduction of boron tribromide by hydrogen in the neighborhood of incandescent wires of tantalum, molybdenum, and tungsten. The reduction occurs when a flowing mixture of boron tribromide vapor and hydrogen gas passes over the incandescent wire on which the elemental boron deposits. Preliminary results indicate that the boron deposits probably have a purity in excess of 99 per cent.

The boron tribromide was made by reacting bromine with commercially available elemental boron in a furnace at 850°C. and purifying in a specially designed distilling unit. Glass apparatus for carrying out the reduction step is described.

Most of the massive black deposits of boron were clearly crystalline, exhibiting sharply defined faces; however, some apparently amorphous material was observed. In addition, shiny black spheres up to 0.1 millimeter in diameter and having densities approximately that of boron were found. Their presence is difficult to account for on basis of melting since the measured temperature of the wire never exceeded 1300°C., which is about 900°C. lower than the reported melting point of boron. If the spheres were formed from liquid material, then the energy required for the melting of the boron may be associated with the catalytic recombination of hydrogen or bromine atoms or condensation of boron atoms at sites with low heat dissipation rates. Their presence might also be accounted for by assuming that the boron is deposited in a vitreous form, in which case the onset of softening could be at a relatively low temperature.

Future work planned includes (1) the establishment of the purity of the boron deposits, (2) a study of their structure, and (3) an investigation of the oxidation behavior of boron.

23. Absorption of Undiluted Vapors by Drops.

William E. Rice; *Experiment Incorporated.*

The evaporation of liquid drops moving through air and the absorption by drops of soluble gases diluted with air have been studied exhaustively [W. E. Ranz and W. R. Marshall, Jr., *Chem. Eng. Progr.*, *48*, 141-146 and 173-180 (1952).] But work has just begun [R. R. Hughes and E. R. Gilliland, *Chem. Eng. Progr.* Symposium Ser. No. 16, *51* 101-120 (1955)] on absorption of undiluted soluble gases.

Diffusion in the gas phase probably does not limit absorption rates

of pure gases unless the vapor pressure of the drop substance is quite high, since any boundary layer will be composed almost entirely of the "diffusing subsatnce."

In the present work, absorption of ammonia by falling water drops was measured. Most instances showed a pickup, within a few milliseconds, of a quarter of the amount required to saturate the drop. Then the absorption rate became slower.

Possible rate-limiting processes are (1) diffusion in the liquid phase and (2) the striking of the drop surface by ammonia molecules, with a sticking probability that varies with surface composition.

Liquid-phase diffusion, whether rate-limiting or not, must be aided by circulation to account for the high absorption rates found. In one case of absorption of the less soluble carbon dioxide, circulation accompanying transient drop oscillations proved rate-limiting. Absorption rates of ammonia decrease much faster with time.

The project was sponsored by the Army Ordnance Corps.

24. SPARK IGNITION OF DUST CLOUDS.

Lloyd E. Line, Jr., and James C. Rahman; *Experiment Incorporated.*

The previously described apparatus [Lloyd E. Line, Jr., and Wendall J. Clark, *Va. J. Sci.*, *6*, 258 (1955)] for studying dust explosions has been employed with certain modifications to obtain information on the ignition limits of lycopodium, magnesium, and boron dusts suspended in oxygen-inert diluent-gas mixtures.

Essentially two kinds of experiments are being carried out: (a) the determination of the minimum percentage of oxygen required in an O_2-diluent mixture for ignition, with a fixed spark energy, of a column of dust of fixed concentration, and (b) determination of the minimum spark energy required for ignition of a column of dust of fixed concentration suspended in an O_2-diluent mixture of fixed composition. These minima, unlike those of combustible gases, are not sharply defined. Instead there is a range of oxygen concentration or of energy in which there is only a certain probability that ignition will occur.

Results are presented concerning the effect on ignition of the absence or presence of a confining wall, of the spark gap distance, and of other apparatus parameters. Some results are presented also on the effect on the ease of ignition of (a) using either nitrogen or helium as the diluent, (b) oxygen concentration, (c) dust concentration, and (d) particle size. These were obtained in order to gain a preliminary understanding of the underlying basic phenomena.

25. FORMATION OF IONS IN FLAMES.

H. F. Calcote and I. R. King; *Experiment Incorporated.*

The abnormally high concentration of ions in the combustion zone or inner cone of a Bunsen flame is probably related to nonequilibrium electronic excitation, but the mechanism of such processes still requires elucidation. It is the purpose of this paper to survey the mechanisms which have been considered for the formation of ions and to discuss these in terms of the experimental evidence, including some new results obtained with a Langmuir probe.

The following explanations of ionization have been considered 1. Thermal ionization of impurities with low ionization potentials, such as the alkali metals. 2. Thermal ionization of radicals with low ionization potentials, e.g., C_2, CH and OH. 3. Thermal ionization of small carbon particles where the ionization potential approaches the work function, 4.4. e. v. 4. Chemical energy released as translational energy. 5. Chemiionization. 6. Collisions of the second kind.

The research was conducted under the auspices of Project SQUID.

26. SEMIQUANTITATIVE ANALYSIS OF ALKYL ACID POLYPHOSPHATE MIXTURES.

T. M. Melton; *Virginia-Carolina Chemical Corporation.*

Alkyl acid polyphosphate mixtures are obtained by the reaction of aliphatic alcohols with phosphorus pentoxide. A method has been developed for the determination of the relative amounts of mono-, di-, tri-, and polyphosphate components present in the alkyl acid polyphosphate mixtures. Trends in the change in composition with different reaction conditions are discussed.

27. VAPOR PHASE CHROMATOGRAPHY.

Robert B. Seligman, Frank E. Resnik, Andrew E. O'Keeffe, Joseph C. Holmes, Francis A. Morrell, and Donald P. Murrill; *Philip Morris and Company, Ltd., Incorporated.*

Vapor phase chromatographic analysis is well suited to work with complex liquid and gaseous mixtures because of the extremely small sample size needed, the rapidity of the method, and the efficiency of the separations.

The physical set-up, transfer of samples to the chromatographic columns, preparation and development of these columns, and trapping of fractions for analysis with the mass spectrometer are discussed.

28. THE USE OF THE MASS SPECTROMETER AS A QUALITATIVE TOOL.

Frank E. Resnik and J. C. Holmes; *Philip Morris and Company, Ltd., Incorporated.*

It is well known that mass spectrometers are used extensively for the quantitative analysis of mixtures of known compounds; however, our objective is to show how it can be used as a qualitative instrument.

A brief description of the mass spectrometer will be given consisting of the physical layout, the analyzer assembly, and the sample introduction system which includes a heated inlet system.

The techniques used to effect qualitative identification of compounds from a mass spectrum are: (1) uniqueness of spectra; (2) mass intervals to identify fragments and elements present; (3) peak-free regions to establish the absence of compounds; (4) identification by stable isotopes, and (5) characteristic peak shapes and distinctive groupings, such as metastable and half-mass peaks.

Another important technique in qualitative analysis is the use of high resolution mass spectrometry. This technique utilizes the principle that atomic masses are not exactly integral numbers; thus separation of oxygen-nitrogen- or sulfur-containing compounds from hydrocarbon compounds can be accomplished. Resolution of ion pairs of known compounds is presented and its application to unknown compounds discussed.

The use of the mass spectrometer in conjunction with gas chromatography will be discussed.

BUSINESS MEETING

A nominating committee consisting of Robert E. Cunningham, Chairman, Jane Bell Gladding, and Henry Leidheiser nominated the following candidates as officers of the Chemistry Section for 1956-57: *Chairman*, Mary E. Kapp; *Secretary*, Joe H. Holmes. These officers were elected by a unanimous vote of the members present. No other business was transacted.

29. THE ELECTRODEPOSITION OF ALUMINUM FROM ETHER-AMINE ALUMINUM CHLORIDE SOLUTIONS.

N. F. Murphy and A. C. Doumas; *Virginia Polytechnic Institute.*

Three-component solutions of amines dissolved in ether and aluminum chloride have been found to be electrical conductors and to deposit aluminum from the solution. The three-component system has a single-phase area in which the deposits are adherent and smooth. The

extent of the single phase area depends on the amine and ether used. In addition to ethyl ether, other, higher-boiling ethers may be used, but if the molecular weight of the ethers is too high, the deposits are of poor quality. The amines used include *n*-butyl amine, 2-ethyl hexyl amine, di-butyl amine and tri-butyl amine. Other amines would be suitable, if the molecular weight is not too high. The bath must be provided with a recovery system for the volatile solvents since the bath operates at the boiling points. High current densities have been shown to form highly polished deposits, and these high current densities permit deposition in rapid strip machines.

30. GAS PHASE OF CIGARETTE SMOKE: THE EFFECT OF CHANGES IN SMOKING TECHNIQUE ON THE CO_2:CO CONCENTRATION RATIO.

J. Scott Osborne, Jr. and Edward S. Harlow; *The American Tobacco Company.*

The influence of speed of puff on the CO_2:CO concentration ratio was studied. By speed of puff is meant the puff volume divided by the duration of the puff. Other variables of the smoking process were held constant to the extent feasible. A simple smoking apparatus allowing independent variation of puff volume and duration was constructed and used, and analyses were accomplished with a double beam infrared spectrophotometer. Under the experimental conditions described, the CO_2:CO ratio decreased with increasing speed of puff. An expression of the form of $y = ax^n$ was found to fit the experimental data, giving a linear log-log plot. A brief discussion of the results is included.

31. ACID AND BASE CATALYSIS IN THE SOLVOLYSIS OF ALKYL BORATES.

Gilbert T. Perkins and Thomas I. Crowell; *University of Virginia.*

The rate of reaction of *sec.*-butyl borate with ethanol, to form ethyl borate, was measured dilatometrically at 0° and 25°C. Acetic acid, acetate ion, ethylonium ion, and ethoxide ion all accelerated the alcoholysis. Experiments using buffer solutions at constant ionic strength showed general acid and base catalysis. Small amounts of water also accelerated the reaction except when it was acid catalyzed, in which case, the conversion of ethylonium ions to the less reactive hydronium ions decreased the rate.

Isopropyl borate reacted twelve times as fast, and *tert.*-butyl borate only a fraction as fast as the *sec.*-butyl ester. Esters of primary alcohols apparently reacted too rapidly for measurement.

The reaction mechanism is discussed with reference to the catalysis, structural effects, and activation energies observed.

32. OXIDATION OF BORON WITH HYDROGEN PEROXIDE.

Ira A. Updike and Grover L. Farrar; *Randolph-Macon College.*

This paper reports a new quantitative method of oxidizing elemental boron together with some combined boron. Because of the difficulty in obtaining pure boron by the commonly employed reduction processes, commercial samples of the element usually contain considerable impurites, 10-15 per cent, of unspecified composition, but frequently spoken of as borides and suboxides. These impurities may present difficulties in the oxidation of boron to orthoboric acid. The presence of HCl, HNO_3 and NaCl reduce the solubility of boric acid and thus could be a disadvantage in the oxidative dissolution of boron.

Our study confirms previous work that hot *aqua regia* reacts with finely powdered boron and also with accompanying impurities containing combined boron to give orthoboric acid. Another method, which appears more feasible, has been found for dissolution of the sample.

The quantitative oxidation of boron by our reagent, concentrated hydrogen peroxide, is especially advantageous in that reaction begins spontaneously and proceeds without applied heat, whereas the *aqua regia* method requires heating under reflux with special precautions to prevent loss of boric acid by steam distillation.

33. A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF NICKEL IN HUMAN BLOOD.

Maxwell L. Cluett and John H. Yoe; *Pratt Trace Analysis Laboratory, University of Virginia.*

Gram atom absorptivity values of several Ni (II) chelates were compared in order to select the most sensitive reagent for the spectrophotometric determination of trace amounts of nickel. A separation procedure based on the behavior of Ni (II) and interfering metal ions on an anion exchange resin in strong hydrochloric acid solution and on a calcium carbonate column in alkaline solution has been developed. The blood samples were wet ashed with nitric acid at 350°C. The procedure has been used to establish the "normal range" for nickel in human whole blood.

34. DETERMINATION OF BORON IN PLANT TISSUE WITH A NEW GROUP OF COLORIMETRIC REAGENTS.

Everett C. Cogbill and John H. Yoe; *Pratt Trace Analysis Laboratory, University of Virginia.*

Diaminochrysazin, diaminoanthrarufin, and tribromoanthrarufin give sensitive color reactions with borate ion in concentrated sulfuric acid solution. The color change with diaminochrysazin is from lemon yellow to

orange; that of diaminoanthrarufin, from brownish yellow to deep blue; and that of tribromoanthrarufin, from reddish violet to bright blue. A spectrophotometric study has been made of the three compounds as colorimetric reagents for the determination of trace amounts of boron, particularly in biological material. Their spectrophotometric sensitivities in 95.4 per cent sulfuric acid are, respectively, 0.0022, 0.0025 and 0.0009 micrograms of boron per square cm. at their optimum analytical wavelengths; and with them, quantities of boron in the range 2 to 7 micrograms may be determined spectrophotometrically with a precision of less than 1 per cent. The effect upon the color reactions of the variables, time, temperature, concentration of sulfuric acid, and presence of diverse ions have been studied. Titanium is the only common metallic ion likely to interfere; oxidizing anions and fluoride must be absent. For the determination of boron in plant tissue, a procedure has been developed employing wet digestion and separation of the boron by methyl borate distillation. By means of it, with the diaminochrysazin as the colorimetric reagent, quantities of boron between 6 and 12 micrograms in a 0.1-0.3 g. sample of plant tissue may be determined with a precision of 4 per cent.

35. A NEW CLASS OF ORGANIC REAGENTS FOR THE SPECTROPHOTOMETRIC DETERMINATION OF TRACE AMOUNTS OF OSMIUM.

Edgar L. Steele and John H. Yoe; *Pratt Trace Analysis Laboratory, University of Virginia.*

The investigation of the naphthylamine sulfonic acids as analytical reagents for osmium has followed three main courses. The first, to determine the applicability of the osmate (VI)-1-naphthylamine-3, 5, 7-trisulfonic acid complex to the quantitative estimation of trace amounts of osmium. It was found that this reagent is very sensitive to osmium (VI).

The second part of the investigation involved the separation of osmium from interfering substances. This was accomplished by oxidizing the osmium to the tetraoxide and distilling. The tetraoxide was then reduced to osmium (VI) by hydroxyl ions, the valence state required for forming the colored complex.

The third part of the investigation deals with structural analysis of the osmium complexes. The nature and position of the amine nitrogen and of the sulfonic acid groups are being studied to determine their effect on complex formation and stability. A series of twenty-four different naphthylamine sulfonic acids are being used in this study.

36. A STUDY OF THE BORON-CURCUMIN SYSTEM.

W. Allan Powell and Emmett H. Poindexter; *University of Richmond.*

Turmeric, an impure material containing the yellow coloring matter,

curcumin, has been used for the colorimetric determination of boron for more than fifty years. Many modifications and applications have been reported; however, much still needs to be learned about the mechanism of the reaction. In the present study an attempt has been made to obtain a better understanding of this reaction.

Evidence has been obtained which indicates that the red color formed in the turmeric method is that of a boron-curcumin-oxalic acid complex having a molar ratio of 1-1-1. Oxalic acid increases the sensitivity of the method by increasing the rate of reaction, apparently by chelating with the boron prior to reaction of the boron with curcumin. This chelation activates the boron and makes it more susceptible to reaction with curcumin. Of twenty-eight compounds studied, oxalic acid was found to be most suitable for sentization of the method.

37. PROGRESS REPORT OF STUDIES OF THE COORDINATION OF CATIONS OF THE FIRST TRANSITION SERIES BY SEVERAL POLYHYDROXYLAMINE HYDROCHLORIDES.

W. P. Moore and Wm. E. Trout, Jr.; *University of Richmond.*

1, 3-trishydroxymethyl-methyl-amino-ethane dihydrochloride; 1, 2, 3-trishydroxymethyl-methyl-amino-propane trihydrochloride, and 1, 3-trishydroxymethyl-methyl-amino-propanone dihydrochloride were prepared. The composition and stability of chelates formed by these organic compounds and cations of the first transition series were studied.

38. THE DETERMINATION OF FORMIC ACID AND OTHER VOLATILE ACIDS.

B. R. Warner,* R. D. Carpenter, and L. Z. Raptis; *Philip Morris and Company, Ltd., Incorporated.*

A method developed for determining formic acid and other volatile acids utilizes separation by means of successive azeotropic distillations from a single sample. The formic acid is distilled with chloroform, and the acetic acid with benzene. The acids are then determined quantitatively by titration with methanolic sodium hydroxide.

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* Deceased

MINUTES OF THE SECTION OF EDUCATION (6)

DEFOREST L. STRUNK, II, *Chairman*
W. DONALD CLAGUE, *Secretary*
JAMES B. PATTON, JR., *Section Editor*

FRIDAY, MAY 11, 1956–9:00 A. M.–ROOM 11
SECOND BAPTIST CHURCH, 7 EAST FRANKLIN STREET

1. A PROGRESS REPORT ON THE JOINT STUDY OF THE QUALITIES OF EXPERIENCE FOR PROSPECTIVE TEACHERS.

J. P. Wynne; *Longwood College.*

The American Association of Colleges for Teacher Education and The Philosophy of Education Society have appointed a Joint Committee to study ways and means of defining desirable qualities of experience and of defining a tentative set of such qualities as a starting point for further studies on the part of schools and colleges. This committee consists of the following: Karl W. Bigelow, Teachers College, Columbia University, Chairman; William F. Bruce, Washington, D. C.; Franklin H. McNutt, Woman's College of University of North Carolina; G. Max Wingo, University of Michigan; John P. Wynne, Longwood College, Farmville, Virginia.

The outline of the study approved by the two organizations involves: 1. Defining the idea of the qualities of experience, 2. Defining the qualities which are found through systematic study to be desirable, 3. Securing from educational philosophers representing different schools of thought criticisms of the idea of qualities of experience and of the particular qualities defined, 4. Securing from specialists in various kinds of education their reactions to the idea of qualities of experience and to the particular qualities defined, 5. Developing techniques of studying and cultivating qualities of experience for use in particular situations.

The Joint Committee has developed Items 1 and 2 in a preliminary manuscript. The standard qualities of experience proposed and defined are designated as: (1) The quality of relevancy, (2) The quality of sociality, (3) The quality of satisfaction, (4) The quality of creativity, (5). The equality of intelligence, (6) The quality of unity. The Committee will ask persons representing a variety of interests to criticize the manuscript. Their suggestions will be used as a basis of revision. The revised manuscript will be sent to educational philosophers representing

various schools of thought and to outstanding specialists in different kinds of education in order to obtain data for use in preparing Items 3 and 4. The data for use in preparing Item 5 are to be secured from reports on the use of the manuscript in schools and colleges.

2. EXPERIMENTAL STUDY IN THE TEACHING OF ARITHMETIC.

Francis G. Lankford, Jr. and Evan G. Pattishall, Jr.; *University of Virginia.*

Experimental and control conditions were randomly assigned to each of eighteen pairs of intact, non-homogeneous fifth grade classes. The experimental conditions involved the teaching of addition and subtraction of fractions with the help of experimental materials emphasizing two important features: (1) ideas and rules of arithmetic were developed inductively through pupil participation rather than the more usual method of teacher explained rule followed by practice, and (2) pupils were encouraged to learn arithmetic thoughtfully and independently using mental arithmetic with emphasis on varied approaches. The control conditions involved the use of the best teaching as normally employed by the designated control teachers.

The experimental design included the use of analysis of covariance using the California Arithmetic Test and the Californnia Mental Maturity Test as initial X_1 and X_2 variables respectively for all groups. A final Y variable test was constructed to measure pupil achievement in fractions at the completion of the five-month experiment.

Results demonstrated the experimental groups to be: (1) significantly superior in the mean number of correct answers on final achievement test, and (2) significantly superior in expression of arithmetical concepts through mental computation. Other significant results in achievement and expressed attitudes are discussed.

3. ENRICHING THE SCHOOL PROGRAM THROUGH AUDIO-VISUAL AIDS.

Edwin M. Logan; *University of Virginia.*

Research has revealed that audio-visual materials can play a vital role in educational programs ranging from elementary grades through the university levels. Among other contributions to more effective teaching, audio-visual aids stimulate interest, reduce teaching time, and make learning more permanent and meaningful.

Aware of this research, the writer undertook a project under the auspices of the University of Virginia which dealt with enriching the school program through the use of audio-visual aids. First, a survey was conducted in a Virginia county which revealed numerous weaknesses in the existing audio-visual program—facilities, administration,

and utilization of sensory materials.

After analyzing survey results, both teachers and administrative personnel recognized and desired to strength weaknesses at both the school and county levels.

To correct these deficiencies, various audio-visual activities were undertaken. Some activities included were: (1) demonstrating and teaching the operation of equipment such as motion picture projectors, tape recorders, and vu-graphs; (2) helping the school Bureau of Teaching Materials representatives to better understand their role as well as their functions with local, regional, and state bureaus of teaching materials; (3) participation of many teachers and principals in the county in preparing a local field trip directory; (4) helping teachers achieve more effective utilization of films in their classrooms; (5) darkening classrooms adequately for use of audio-visual materials; and (6) demonstrating the various uses of the felt board.

All of these activities, and others too, were carried out at the school level. Suggestions for the county, embracing supervisory, administrative, and budgetary considerations, were recommended and accompanied by a practical plan for their implementation.

At this time, the interest shown in activities already conducted and the sustained interest displayed thus far during the current school year has resulted in the instructional program of this Virginia county being greatly enriched through the effective use of audio-visual materials.

4. A COMPARISON OF SUBJECTIVE PREDICTIONS WITH OBJECTIVE PREDICTIONS OF COLLEGE ACHIEVEMENT.

Marshall Moore Brice; *Staunton Military Academy.*

The purpose of this study was to compare objective predictions—intelligence test results and twelfth grade averages—with subjective predictions made by secondary school teachers as to academic achievement in college. Statistics were derived from records of graduates in three recent Staunton Military Academy classes—244 students attending 101 different colleges.

Each subjective prediction was converted to a statistical equivalent between 0 and 100 on a predetermined scale. Grade point averages in the college freshman year constituted the criterion, with which six predictive factors were compared: Otis IQ's; Q-scores, L-scores, and total scores on ACE Psychological Examinations; twelfth grade averages; and averages of teachers' predictions, called predictive rating averages.

Only two predictive indices correlated significantly with the criterion: predictive rating averages, .478; and twelfth grade averages, .412. Intercorrelations computed among variables indicated that subjective predic-

tions, although influenced by academic marks, emanated also from other factors.

Results appear to warrant the conclusions that secondary schools sending graduates to many different colleges should base prognosis principally upon subjective predictions and academic averages, and that it is possible to reduce subjective predictions to numerical equivalents which are of somewhat greater reliability than are twelfth grade averages.

BUSINESS MEETING

The report of the nominating committee was presented and the following officers were elected to serve for the year 1956-1957: *Chairman*, W. Donald Clague; *Secretary*, Evan G. Pattishall, Jr.

MINUTES OF THE SECTION OF ENGINEERING (7)

ROBERT W. TRUITT AND NELSON F. MURPHY, *Co-Chairmen*
DAVID M. CRIM, *Secretary*
ROBERT M. HUBBARD, *Section Editor*

FRIDAY, MAY 11, 1956—9:30 A. M.—VIRGINIA ROOM, JEFFERSON HOTEL

1. A NOTE ON THE SLOPE OF THE LIFT CURVE IN TWO-DIMENSIONAL TRANSONIC FLOW.

Robert W. Truitt; *Virginia Polytechnic Institute.*

Experimental pressure distribution over the front half of a symmetric diamond wedge, at small angle of attack, was integrated to find the slope of the lift curve. The experimental lift-curve slope was compared with existing theory in the transonic range. The experimental local Mach number variations were presented and discussed.

2. AN EXPERIMENTAL INVESTIGATION OF TRANSONIC BASE PRESSURES.

Robert W. Truitt, Arthur C. Bruce, and Gerald D. Walberg; *Virginia Polytechnic Institute.*

The transonic base pressures on an ogival body of revolution, with a short cylindrical afterbody, were measured in the V. P. I. transonic wind tunnel under conditions of varying wall configuration and porosity. The results of these tests showed that the base pressure drag reached a peak value in the transonic region, but different test configurations caused the maximum value of base pressure drag to occur at different Mach numbers. An increase in wall porosity caused an increase in base pressure drag co-efficient and a decrease in base pressure ratio. The measurement of free-stream static pressure was found to have a profound influence on values of base drag coefficient.

From the results of this investigation it is concluded that transonic base pressures may be found from wind tunnel tests, but that care must be taken in the measurement of free-stream static pressure and in the distribution of wall porosity.

3. SOME ASPECTS OF TWO-DIMENSIONAL SUBSONIC FLOW.

Arthur C. Bruce and Robert W. Truitt; *Virginia Polytechnic Insitute.*

Some of the details concerning application of subcritical and super-

critical subsonic solutions to a simple wedge were described. In particular, it was shown that the Schwarz-Christoffel (exact) solution can be used only in Gothert's Similarity Rule. The solution thus obtained predicted a forward movement of the $C_p = 0$ point with increasing Mach number; this was found to be in direct contradiction to experiment. It was shown that if boundary layer effects are considered, better qualitative agreement with experiment is obtained in this respect. An analysis of the results of subcritical and supercritical theories indicated a very simple solution from a free-stream Mach number of zero to Mach numbers in excess of unity. It was pointed out that experiment does not completely verify the existence of the local Mach number freeze; by applying Cole's "unit chord solution" between the stagnation and the experimentally determined body sonic point, excellent quantitative agreement with experiment was obtained.

4. A NOTE ON THE LIMITATIONS OF THREE-DIMENSIONAL LINEAR THEORY FOR COMPRESSIBLE FLOW.

James B. Eades, Jr.; *Virginia Polytechnic Institute.*

The limit of applicability of linear theory was investigated. An upper limit was defined for which linear theory may be assumed to give a reasonable approximation of aerodynamic phenomena about a symmetric body of revolution in axisymmetric flow. To illustrate this range of applicability, an investigation was carried out on the pressure coefficient about a special class of bodies, meeting the requirement of this investigation; the pressure coefficients were corrected by linear approximation, and a comparison with experiment was made. The result of such an extension was shown in graphical form.

5. A NOTE ON THE HYPERSONIC FLOW ABOUT TWO-DIMENSIONAL BLUNT BODIES.

Robert W. Truitt; *Virginia Polytechnic Institute.*

A simplified analysis of the flow at Mach number 5.8 over a two-dimensional circular cylinder was made for (i) the case of a normal detached shock wave and (ii) the case of a slightly curved detached shock wave. The theoretical pressure distributions were shown for the two cases and it appeared that the addition of a shear flow analysis improves the accuracy of the subsonic pressure distribution when the detached shock wave is curved. The present results were compared with available experimental data.

6. A FIRST APPROXIMATION TO AERODYNAMIC RESPONSE OF A TWO-DIMENSIONAL AIRFOIL TYPE IN SINGLE DEGREE OF FREEDOM MOTION.

James B .Eades, Jr. and Frank B. Anthony, Jr.; *Virginia Polytechnic Institute.*

A two dimensional mathematical airfoil was investigated, under the assumption of a quasi-steady aerodynamics, to determine the aerodynamic response of the airfoil to vertical and angular single degree of freedom motion. Experimental tests were conducted in the Virginia Polytechnic Institute subsonic wind tunnel to determine the correlation between the response predicted by a theory of this type and the response of the actual case. The analysis represents a first approximation to be the determination of the response of an airplane wing to flutter and vibrational motion.

7. SOME CONSIDERATIONS OF PRESSURE-DRAG OVER THE FRONT SURFACE OF TWO-DIMENSIONAL WEDGES HAVING DIFFERENT AFTERBODY CONFIGURATIONS.

William P. Harrison, Jr. and Robert W. Truitt; *Virginia Polytechnic Institute.*

This paper presented a general discussion of pressure drag over the front surfaces of two-dimensional wedges, with particular emphasis placed on afterbody effect. Considerations were made of existing theory and experimental results in the subsonic, transonic, and supersonic regions.

With regard to the theoretical determination of drag in the transonic range, the three most frequently used approximate methods, namely those of Cole, of Guderley and Yoshihara, and of Vencenti and Wagoner, were mentioned. Comparison of these results for drag over the front surface of two different wedge families—one having a symmetrical diamond profile and the other having a straight after-body of infinite length—with experimental data revealed that some discrepancies exist throughout the literature where application has been made of the three theoretical solutions. These differences between theory and experiment were discussed briefly.

It was concluded that the work of Cole, Guderley and Yoshihara, and Vencenti and Wagoner has done much to enhance a better understanding of the transonic-drag problem. Furthermore, it was concluded that more exact theoretical methods need to be developed which will take into account the secondary effects of afterbody shape and provide a continuous solution from Mach number zero through the transonic range.

8. RESULTS AND APPROXIMATE METHOD FOR DETERMINING TRANSONIC PRESSURE-DRAG OVER THE FRONT SURFACES OF TWO-DIMENSIONAL WEDGES HAVING DIFFERENT AFTER-BODY CONFIGURATIONS.

George E. Powell and Robert W. Truitt; *Virginia Polytechnic Institute.*

An approximate method of analysis was used to determine the effect

of after-body on front surface pressure drag coefficient on two different wedge profiles within the transonic range. The bodies considered were a symmetric diamond airfoil and a wedge with a straight after-body, both having 7.5 degree semi-opening angle.

The method of analysis used was commonly referred to as the "throat station concept." According to the throat station concept, the front surface pressure drag coefficient is a function of the subsonic pressure distribution. This indicates that the after-body configuration has a definite effect on the front surface pressure drag coefficient, even in the transonic range.

A comparison of the present method with experimental and theoretical results was presented and discussed. In particular, it was found that experiment indicates an appreciable effect of after-body which is predominantly viscous in nature and not compressible.

9. OPERATIONAL ANALOGS AS DYNAMIC ENGINEERING MODELS.

O. L. Updike, Jr.; *University of Virginia.*

Structural analogs, or models, of thermal, electrical, mechanical, and hydrodynamic systems have long been used in engineering research and design. Complementing these, functional electrical analogs which closely approximate mathematical operations are now coming into wide acceptance. Use of these "operational analogs" is illustrated by problems of chemical reaction, control system simulation, and biological growth. The balanced accuracy, speed, simple operation, and versatility of this equipment recommends it for many engineering tasks. With it, most engineers can set up and solve their own problems, in contrast to digital computers which require mathematical specialists as operators.

10 SYNOPSIS OF HIGHWAY SIGN BRIGHTNESS IN RELATION TO POSITION, DISTANCE, AND REFLECTORIZATION.

Arthur L. Straub and Terrence M. Allen; *Virginia Council of Highway Investigation and Research.*

The nighttime brightnesses of highway signs vary with incident illumination and the reflective properties of the sign materials. The incident illumination depends on the headlamp isocandle distribution, and the position and distance of the sign from the headlamp. For a given incident illumination, the brightness of the sign depends on the entrance and divergence angles.

This paper presented a series of curves of sign brightnesses for typical sign materials as seen by a driver approaching from a distance of 2,000 feet. Several lateral and vertical positions of the sign were assumed, and tangents, vertical curves, and horizontal curves were taken into account.

The data presented were derived from geometrical relationships between the headlamps, driver, and sign, the isocandle distribution characteristics of headlamps, and laboratory test results for reflective materials. A field validation of the derived data was reported. The significance of sign brightness to target value and legibility was discussed.

11. EQUILIBRIUM DATA FOR VISCOUS TERNARY SYSTEMS.

John C. Howard; *University of Virginia.*

The paper described a method developed to determine equilibrium data for viscous ternary liquid systems. Index of refraction and density were the analytical methods employed, and Hand coordinates were used to check the accuracy of the data. Using this method, equilibrium data were determined for the systems Propylene Glycol-Tributyrin-Di (methoxy ethyl) Phthalate, and Propylene Glycol-Di Octyl Phthalate-Acetic Acid at 25°C.

12 HEAT TRANSFER IN NARROW ENCLOSED GAS SPACES.

John R. Marshall; *University of Virginia.*

The ability of gas in small enclosed spaces less than 0.08 inch thick to conduct heat is affected by changes in temperature, pressure, orientation of space, and the nature of the gas. A special hot plate apparatus for studying heat transfer in such spaces was described, and the results of investigating the effects of these variables on the heat transfer properties of carbon dioxide, air, Freon-12, and helium between parallel plates were given. As the gas space thickness increased, the heat transferred decreased and convection became the important mode of heat transfer. The modes of heat transfer were affected by pressure only at very low pressures when heat transfer decreased largely due to the decrease in thermal conductivity of the gas. The amount of heat transferred decreased as the gas space was rotated from horizontal to vertical when the heat transferred by convection was appreciable.

13. THE EFFECT OF SUPERIMPOSED ALTERNATING CURRENT AND PERIODIC REVERSE CURRENT ON THE YIELD OF ELETROCHEMICAL REACTIONS.

N. F. Murphy and B. C. Doumas; *Virginia Polytechnic Institute.*

Electrochemical preparation of pigment grade lead chromate was studied with periodic reverse current. The direct to reverse current time ratio varied from 1 to 20, anode current density was 0.0059 ampere per square centimeter, and temperature was about 33°C. Electrolyte solutions contained K_2CrO_4 with $NaNO_3$, and K_2CrO_4 with $NaNO_3$. The yield and purity of lead chromate were not improved by using periodic reverse compared to using direct current.

Also studied was the effect of superimposing 60-cycle and 500-cycle alternating current of variable magnitude on constant direct current during electrolysis of potassium chromate solution between lead electrodes. The electrolyte contained 3.6 grams K_2CrO_4 and 11.62 grams $NaNO_3$ per 1000 grams H_2O. Solution pH was kept at 6.0 and the temperature was about 30°C. The ratio of peak alternating current to direct current varied from 0.25 to 2.91 so that both pulsating and reverse currents were studied. With 60-cycle superimposed alternating current the yield of lead chromate decreased sharply when the current changed from pulsating to reversing. This was not observed with 500-cycle current. Purity of the product obtained using 500-cycle current was higher than that obtained using direct current or 60-cycle superimposed current. There was no decrease in yield. Anode corrosion efficiency for 500-cycle current was equal to that with direct current and greater than that obtained with 60-cycle superimposed current.

14. BARIUM TITANATE PROBE FOR ULTRASONIC INTENSITY MEASUREMENTS.

N. N. Bakhshi and F. C. Vilbrandt; *Virginia Polytechnic Institute.*

Assurance of uniformity of intensity and a measurement of the degree of intensity in ultrasonorated media was accomplished by the design and construction of a laboratory probe. A cylindrical, tiny barium titanate piezoelectric element was used as the source for evaluating loci throughout a solution undergoing ultrasonation in 2-inch diameter cylindrical "Sonicell" laboratory equipment. Details of probe design and data of intensities in the overall field were presented.

BUSINESS MEETING

Mr. Murphy convened the business meeting at 4 P. M. Three members of the Junior Academy of Science were invited to describe the project each exhibited at the meeting. From these three contestants, Mr. Benton Durley of Falls Church High School was selected to receive the 1956 George Washington Engineering Award.

The previously appointed nominating committee presented the following names on a slate of officers for the year 1956-1957, who were elected unanimously: *Chairman*, David M. Crim; *Secretary*, Otis L. Updike, Jr.

The possibility of limiting the subject of papers presented at the next annual meeting of the Section to some topic of general interest to several branches of engineering was discussed, and general approval of this plan was given. Instrumentation and control was mentioned as a possible topic.

The Section Editor reported that one paper previously presented at the Charlottesville meeting of the Section by Robert F. Fleming had been printed in the Journal in Vol. 7, No. 2, April 1956.

Mr. Bernard Niemeir suggested that the Section consider making an effort to have established in Virginia a museum of scientific and technical exhibits that would be beneficial and instructive to students and the technically uninformed. Without takng any formal action on this suggestion, the meeting adjourned at 4:45 P. M.

MINUTES OF THE SECTION OF GEOLOGY (8)

WILLIAM T. PARROT, *Chairman*
TROY J. LASWELL, *Vice-Chairman*
ROBERT S. YOUNG, *Secretary*
W. D. LOWRY, *Section Editor* (1958)

FRIDAY, MAY 11, 1956–9:10 A. M.–GAME ROOM, Y.M.C.A.

1. CLEAVAGE IN THE ARVONIA SLATE, BUCKINGHAM COUNTY, VIRGINIA.

Jonathan Edwards, Jr.; *Virginia Polytechnic Institute.*

A study of the cleavage in the Arvonia slate was made in order to determine whether the cleavage is due to a parallel orientation of platy minerals (known as axial plane cleavage), or due to closely spaced fractures produced when the parent shale of probable Ordovician age was tightly folded and converted to slate.

Thin sections show that the cleavage is not related to the mineralogical composition of the bedding. Large porphyroblasts of biotite scattered throughout the slate have been subjected to rotation caused by strike-slip movement. False cleavage was noted in some of the slate.

Striated slickensides are characteristic of many of the cleavage surfaces. It is believed that the cleavage of the slate represents surfaces of shear developed when deforming stresses could no longer be relieved by flexure folding and recrystallization. The common development of joints and minor faults within the slate supports this conclusion.

2. DISTRIBUTION OF TRIASSIC FISH IN THE PIEDMOKT OF VIRGINIA.

Shelton P. Applegate; *University of Virginia.*

Triassic fish have been found at several localities in the Richmond Coal Basin. They occur in the coal measures at Winterpock, Midlothian, and Gayton. They occur outside the coal measures at Hallsboro, Vinita, and half a mile south of Manakin. Fish scales have been reported in the Farmville Basin. One fish has been found in the Danville Basin. In the Potomac area Triassic fish have been found at Midland and near Thoroughfare Gap. The classification of Virginia Triassic fish needs revision. Recognized families are Acrolepidae, Catoperidae, Semionotidae, and Coelacanthidae. The following forms are tentatively recognized: ***Ptycholepis marshi***, Newberry; ***Catopterus redfieldi***, Egerton; ***Dictyopyge macrura***, W. C. Redfield, ***Dictyopyge*** sp. ***Seminoteus*** cf. ***fultus*** (Agassiz), ***Diplurus longicaudatus***, Newberry; and ***Diplurus newarki*** (Bryant)

Schaeffer. These fish appear to be an endemic fresh water fauna with worldwide affinities. They are similar to the Triassic fish of the western United States. The genus *Dictyopyge* seems characteristic of the Richmond Coal Basin. *Catopterus* predominates at Midland and *Semionotus* at the Millbrook Quarry near Thoroughfare Gap. Until the ranges of these forms are better known, it does not seem wise to use them for correlations within the Virginia Triassic.

3. LIGNITE IN COLLUVIUM, SMYTH COUNTY, VIRGINIA.

Charles E. Sears, Jr.; *Virginia Polytechnic Institute.*

Lignite occurs in colluvium overlying a belt of Shady dolomite at an elevation of approximately 3150 above sea level on Brushy Mountain, Smyth County, Virginia. The colluvium consists chiefly of Erwin quartzite with kaolinitic clay in which occur angular quartz grains with inclusions of weathered feldspars. The age of the lignite, as determined from spores and pollen, is either Late Cretaceous or Early Tertiary. The lignite was probably formed on a graded erosional surface at a higher level than that at which it now occurs. It is believed that since the accumulation of the lignite, it has been lowered to its present position mainly by chemical weathering of the underlying Shady dolomite, and subsequently that it has been covered by the colluvial material. Many of the manganese and residual silicia sand deposits in this area are thought to be related to the same erosional surface as that represented by the lignite deposit. Some of the implications that the presence of this lignite has on the erosional history of the area are discussed.

4. DOMESTIC MANGANESE DEVELOPMENTS.

Charles W. Massie; *Virginia Department of Conservation and Development.*

Manganese ore is used for three main purposes: (1) in the steel industry as a reagent in the steel-making process and as an ingredient in special alloy of steels, (2) in the chemical industry as an oxidizing agent in chemical processes and for the production of permanganate and other manganese chemicals, (3) in the manufacture of dry cell batteries as manganese dioxide to serve as a depolarizing agent. It is also used in small tonnage in the production of aluminum and magnesium and in addition is an important alloying element in the manufacture of manganese bronze.

The steel industry consumes about 95 percent of the total amount of manganese produced. Between 14 and 16 pounds of manganese metal are used for each ton of steel manufactured. Because first-grade steel cannot be made without manganese, it is classed as our number one strategic mineral.

Manganese development in the United States has been hampered by the importation of cheap ore from Russia and other countries where it is mined by cheap labor. Our domestic operators, employing the highest paid labor in the world, cannot compete with these imported ores in normal times.

Under the Defense Production Act of 1950, the General Services Administration, in order to stimulate domestic production, is now buying high-grade manganese ore from small producers at a price above the open market. Our domestic production has made rapid strides under this program which, however, expires on June 30, 1958.

5. MINERALOGICAL STUDY OF PART OF THE PATUXENT FORMATION IN VIRGINIA.

William M. Greene, Charles L. Sherman and Dederick C. Ward; *Washington and Lee University.*

A microscopic study of heavy minerals of samples from five areas of the Patuxent formations (Lower Cretaceous) in Virginia was conducted chiefly to identify the minerals present and to determine from their frequency their provenance. The areas from which the samples were taken include, from north to south: Doswell, which is just above the confluence of the North and South Anna Rivers, Drewry's and Chaffin's Bluffs, below Richmond, the classic Dutch Gap, Farrar Island, and Point of Rocks west of Hopewell.

Petrographic examination showed staurolite, leucoxene, magnetite, ilmenite, zircon, muscovite, rutile, and tourmaline to be present in all samples; kyanite and garnet, in nearly all samples; enstatite, epidote, titanite, diopside, and sillimanite, in most samples; and hornblende, monazite, and tremolite in a few samples.

These heavy mineral suites showed such striking similarity both in mineral content and relative frequency as to warrant attributing their origin to a common source of pre-existing crystalline rocks of the Piedmont Province. Anhedral grains of zircon and tourmaline suggest the possibility of an additional provenance composed of sedimentary formations.

6. A STATISTICAL STUDY OF HEAVY MINERALS IN THE SANDS OF THE SOUTH RIVER, AUGUSTA COUNTY, VIRGINIA.

Dorothy Carroll; *U. S. Geological Survey.*

Samples of bed material from above the junction of five tributaries draining the Shenandoah Valley and of five tributaries draining the Blue Ridge were collected according to a plan which would enable the results to be treated statistically. Four samples of material were collected from

each of ten localities. Heavy minerals were separated from the 125- to 62-micron sand size, and 300 grains were identified microscopically in each heavy residue by a random sampling method.

The principal heavy minerals in the sands are opaque minerals (largely ilmenite), zircon, tourmaline, epidote, and rutile. Smaller quantities of chloritoid, amphibole, staurolite, kyanite, garnet, and sphene are also present. Only the grains of opaque minerals and zircon are present in sufficient amounts for a statistical analysis by the method of variance which shows that there is a significant difference in percentages of these minerals carried by streams draining the rocks of the Shenandoah Valley from those draining the rocks of the Blue Ridge. The significance is increased by the results of the examination of four samples from each locality.

7. MINERALOGY OF SEDIMENTS FROM THE VIRGINIA TRIASSIC.

Bruce W. Nelson; *Virginia Polytechnic Institute.*

The sandstones, siltstones, and shales of the Potomac Triassic Basin near Manassas, Virginia contain quartz, feldspar, calcite, hematite, illite, and chlorite. They are arkosic rocks. Quartz, feldspar, and some mica make up the larger part of the silt and sand fractions. Calcite occurs as cement. Hematite occurs in the clay fraction and imparts a reddish color to the rocks. The clay fraction consists entirely of the clay minerals illite and chlorite, in addition to hematite. No kaolinite is present. The clay-mineral composition of these sediments suggests that the basis of mineralogical classification of arkoses should be re-evaluated, and this point is discussed. Quantitative characterization of the illite constituent by Fourier synthesis is illustrated. The chlorite constituent consists in part of a swelling or hydrating variety. Problems related to the arkosic sedimentary rocks of the Virginia Triassic illustrate the need for precise mineralogical determination in sedimentary petrology.

8. GEOPETAL FABRICS OF CLASTIC LIMESTONE.

C. R. B. Hobbs, Jr.; *Virginia Polytechnic Institute.*

During a recent study of oriented thin sections prepared from Cambro-Ordovician limestones in Virginia, top and bottom criteria were noted to be present in the fabric of the carbonate. Recognition of these criteria is reported in the literature, but is generally overlooked in present day thin-section analyses. These fabric relationships which are used to indicate the original position of ancient sediments are called "geopetal" fabrics.

In carbonate rocks these geopetal fabric relationships are defined by the relative position of clear granular calcite to carbonate detritus. The distribution of the carbonate material may be recognized in many dif-

ferent spatial arrangements. These arrangements include areas between carbonate laminae, beneath open fossil shells, in fractured zones, and in solution cavities. Within these structures coarse granular calcite *overlies* the carbonate detritus which is composed of pellet aggregates. It is suggested that the detritus is deposited in openings formed by solution work or resulting from minor adjustments caused by desiccation or load compaction. After emplacement of limestone detritus, calcium carbonate crystallizes from percolating supersaturated fluids and fills the remainder of the original voids.

Because the original orientation of some coherent lime-mud fragments and whole fossils has been changed, more than one geopetal fabric *must* be used.

9. GRANITES AND PHYLLITES OF SOUTHEASTERN PIEDMONT VIRGINIA AND THEIR RELATION TO THE TECTONIC MAPS OF THIS AREA*.

Arthur A. Pegau and William B. Brent; *Virginia Division of Geology* and *Oklahoma A. & M. College.*

The area discussed embraces about 2500 square miles in the southeastern Piedmont of Virginia. The prevailing rock type is a granitized schist-gneiss complex; the next most abundant rock is granite; and the third most abundant is phyllite.

The granite, in roughly lenticular bodies striking a little east of north, is of three general types: (1) a gneissose, medium-textured, light-gray rock in the western part of the area, (2) a porphyritic pink feldspar rock in the southern and central part of the region, and (3) a coarse-grained, equigranular pink feldspar rock in the northeastern part of the area.

There are four bodies of phyllite, presumably derived from material of volcanic origin, in the area: (1) in the southwestern part of the area, part of the Virgilina series, (2) in a narrow strip extending from the State line to Lawrenceville and striking slightly east of north, (3) east of the second body and extending from the State line to Ante, and (4) in the northeastern part of the area striking northwest parallel to and near the border of a granite body.

The bodies of granite and phyllite appear to fit into the southeastern Piedmont Virginia portion of the tectonic map of United States (1944).

10. FEEDER DIKES OF THE CATOCTIN GREENSTONE, ALBEMARLE COUNTY, VIRGINIA.

Tinsley Mack; *University of Virginia.*

Three dikes which cut granodiorite in Albemarle County on the east-

* Presented with the permission of the State Geologist of Virginia.

ern flank of the Blue Ridge are believed to have fed lava to the Catoctin greenstone formation. The petrography of the dikes as to color, texture, and mineral composition is given; the width and attitude of the largest dikes are also noted.

11. PETROGRAPHIC STUDY OF BEACH SANDS FROM CAPE HENRY, VIRGINIA TO NORTH CAROLINA LINE.

J. R. Alford, J. K. Kane, D. M. Marthison, *Washington & Lee University.*

A petrographic study of the beach sands from Cape Henry, Virginia to the North Carolina line showed a similarity of mineral content although a percentage decrease of magnetite, ilmenite, and the less stable minerals from north to south. These recent sediments could not be traced to specific source formations. Because the grains become smaller and more rounded from north to south, Chesapeake Bay is believed to be their predominant geographic origin. Heavy minerals identified, in order of decreasing frequency of occurrence, were: magnetite, ilmenite, leucoxene, zircon, garnet, epidote, staurolite, hornblende, kyanite, tourmaline, sillimanite, muscovite, monazite, hypersthene, brookite, topaz, diopside, olivine, biotite, and enstatite.

12. CHERT-DOLOMITE RELATIONSHIPS IN UPPER KNOX, GILES COUNTY, VIRGINIA.

R. V. Dietrich and W. D. Lowry; *Virginia Polytechnic Institute.*

White porcelaneous chert occurs as syngenetically brecciated fragments in the Upper Knox dolomite along the Mountain Lake road west of Sinking Creek in Giles County, Virginia. Essentially identical but unbrecciated chert is intimately associated with dolomite laminae and also occurs in skeletal chert nodules that contain dolomite. The major dimensions of all the chert masses, except a few of those disrupted by brecciation, are conformable with the bedding. Scattered dolomite rhombs (up to 1 mm. in greatest dimension), concentric banding, and shrinkage cracks and associated phenomena characterize the chert. The associated dolomite strata exhibit primary clastic features and directly above lenticular chert masses constitute supratenuous folds which resulted from differential compaction.

It is concluded that: (1) the enclosing dolomite is either primary clastic dolomite or dolomitized clastic limestone, *i.e.*, essentially volume for volume replacement of calcite by dolomite, (2) the chert is either primary or, at the latest, penecontemporaneous with sedimentation, and (3) the dolomite rhombs probably were formed prior to consolidation of the silica that formed the chert.

13. THE CORRELATION OF PIEDMONT VIRGINIA STRATA AND AN INTERPRETATION OF PIEDMONT STRUCTURE BASED ON THIS CORRELATION.

Wilbur A. Nelson; *University of Virginia.*

The Precambrian Basement Complex is known as the Lovingston gneiss. In ascending order above the Basement Complex are the Rockfish conglomerate, the Lynchburg gneiss, the Swift Run formation, the Catoctin greenstone and the Loudoun formation.

The western part of the Piedmont is composed of a great anticlinorium extending from the Blue Ridge Mountains to Southwestern Mountain. East of this is a great anticlinorium composed of four synclinal belts and three anticlinal belts. The axes of the synclinal belts from west to east are: (1) the Everona limestone of Ordovician age, (2) the Arvonia slate of Ordovician age, (3) the Virgilina-Quantico syncline of Cambro-Ordovician age, and (4) the Gasburg syncline with Swift Run volcanics of Precambrian age.

It is thought that much of the granitization and folding in the Piedmont took place at the close of the Ordovician period and that the pegmatite dikes occurring in belts throughout this area are of the same age. There are several granite stocks of late or post-Paleozoic age.

The oldest major faults are high-angle thrusts which strike northeast. Northwest-striking normal faults displace Pleistocene gravel deposits 5-10 feet.

Several Triassic basins partly obscure older structures.

14. A DIABASE DIKE NEAR AFTON, VIRGINIA.

H. Robert Hopkins; *University of Virginia.*

A diabase dike in Waynesboro, Virginia strikes N.25°W. and dips 75-80° northeast. The dike cuts the country rock at the west entrance of the Blue Ridge Tunnel, at Rockfish Gap, and at the Neese Farm west of Avon, Virginia. Petrographic study of thin sections of the diabase showed no mineralogic or petrographic variations even though the specimens, collected at 100-foot vertical intervals, represent a total difference in elevation of 1200 feet.

15. THE TRANSPORT OF SAND BY WIND.

Edwin F. Ford; *Arlington, Virginia.*

The problem of the motion of an individual sand grain in wind is subjected to a physical-mathematical analysis.

At the surface of the ground on a windy day the air is not moving. The wind velocity increases rapidly as height above the ground increases

and approaches a limiting velocity at approximately one to three feet. Four principal forces act on a sand grain suspended in this wind velocity gradient: (1) the horizontal viscous drag, which tends to reduce the relative velocity between the air and the sand grain to zero; (2) the vertical viscous drag; (3) the aerodynamic lift, which is found by two different thoeretical methods to be proportional to the difference in the squares of the wind velocities at the top and bottom of the sand grains; and (4) the force of gravity.

On the basis of the above analysis differential equations are set up expressing the vertical and horizontal accelerations of the sand grain as functions of the position and velocity of the grain. A theoretical trajectory is calculated for an average sand grain in an experimental wind profile obtained in a home-made wind tunnel. The actual paths of sand grains in the same wind-tunnel profile were photographed. The observed trajectories agree fairly well with those calculated.

16. NATIVE SULPHUR IN GALENA MOLDS IN QUARTZ.

R. V. Dietrich; *Virginia Polytechnic Institute.*

Native sulphur, which contains trace amounts of lead, occurs in cavities in a pyrite-bearing quartz vein approximately 0.5 mile east of Venable Creek and 8.9 miles north of Columbia in Fluvanna County, Virginia. The cavities have terraced cubic outlines with octahedral modifications similar to those that commonly characterize galena.

Measurements of the volumes of the cavities and of the volumes of the included sulphur indicate that the sulphur fills essentially the same proportional part of each cavity (about 13 per cent) and that there is much less sulphur in the cavities as native sulphur than there was as combined sulphur when galena filled the cavities. The shapes of the cavities plus the facts that the sulphur contains trace amounts of lead and that the volume proportion ratio is essentially the same for all cavities measured suggest that the sulphur must have been formed as a result of reactions that involved galena that originally filled the cavities.

The occurrence is of particular interest because removal of lead from oxidized zones is apparently uncommon (especially where pyrite has not been removed) and because derivation of native sulphur from reactions involving galena are apparently even less common.

17. EROSION BY CATASTROPHIC FLOODS IN THE RIDGE AND VALLEY PROVINCE, VIRGINIA.

J. T. Hack; *U. S. Geological Survey.*

During the night of June 17-18, 1949, a severe storm with rainfall exceeding 9 inches centered in Augusta County, Virginia, in the moun-

tainous headwaters of the North River. The drainage basin of a tributary 15 square miles in area suffered severe damage. More than 100 landslides of the debris-avalanche type occurred, and trees and sediments on the valley bottoms were in places completely removed or reworked. Slides were most abundant in the hollows above the stream heads where large areas of soil mantle and rubble were removed and transported to the rivers by the flood. Features resulting directly from the work of the flood, such as terraces on the larger streams, slides, and alluvial cones, have been compared with similar features in areas undamaged by the 1949 flood. It is concluded that severe storms of the type are recurring phenomena in this region and are an important factor in the erosion and formation of the central Appalachian mountain landscape. Damage of a similar type was caused by the flood associated with hurricane Diane in northeastern Pennsylvania during the summer of 1955.

BUSINESS MEETING

At the close of the technical session presided over by Vice-Chairman Troy J. Laswell, the nominating committee placed the following names in nomination for section officers for 1956-1957. All were unanimously elected: *Chairman,* Troy J. Laswell; *Vice-Chairman,* R. V. Dietrich; *Secretary,* Robert S. Young; and *Section Editor,* W. D. Lowry.

The meeting was adjourned at 4:15 P. M.

SATURDAY, MAY 12, 1956—8:30 A. M.—FIELD TRIP

At 8:30 A. M. a group of 30 geologists assembled south of Richmond for the annual field trip. In brilliant sunshine the group headed east to examine the geology of the Virginia Coastal Plain south of the James River. The field trip theme was the Pleistocene history of the area, and the day was spent examining the sediments that underlie the Pleistocene terraces of the Virginia Coastal Plain. A highlight of the morning session was a visit to one of the excellent Yorktown fossil-collecting localities near Claremont, Virginia. After lunch in Surry, Virginia, the group continued east to Newmans Point on the east shore of the Nansemond River north of Suffolk where there is an excellent exposure of the unconformable contact between the Yorktown (Miocene) and late Pleistocene sediments. The group disbanded at 4:00 P. M. The field trip leader was Wayne E. Moore.

MINUTES OF THE SECTION OF MEDICAL SCIENCE (9)

GROVER C. PITTS, *Chairman*

GERALDINE M. DUNCAN, *Secretary*

CHALMERS L. GEMMILL, *Section Editor*

FRIDAY, MAY 11, 1956—9:00 A.M.—WASHINGTON ROOM, JEFFERSON HOTEL

1. AN EVALUATION OF THE METACHROMASY OF ANIONIC DYES[1].

John W. Kelly; *Medical College of Virginia.*

A brief summary of earlier work will provide background for this investigation, which was planned to assess the histochemical value of anionic dyes in localizing basic tissue elements by means of metachromatic reactions.

Thirteen dyes from the *azo*, *indigoid*, *triphenylmethane*, and *xanthene* groups were chosen for this work. Protamine was the basic chromotrope of greatest interest; guanidine, histamine, procaine, quinine, strychnine, and a cationic detergent were also used. Solutions of dyes and chromotropes were screened visually and significant reactions were then studied in the spectrophotometer. Selected tissue sections were stained with all dyes and examined microscopically; some of these will be further studied microspectrophotometrically.

The metachromasy of anionic dyes in this series is of low order. Spectral shifts in solution were not greater than 20 millimicra, compared to 90 millimicra or more for some cationic thiazine dyes.

Diazo and xanthene dyes are most susceptible to external influence; indigoid, monoazo, and triphenylmethane dyes showed no useful color changes. *Trypan* blue, unlike the other diazo dyes, displayed only minor spectral shifts in solution but stained some tissue components *red* and others *blue*. This sharp differentiation appears to be a metachromatic reaction equivalent to those of the most useful basic dyes. The discrepancy between solution and staining observations with trypan blue is now being investigated.

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[1] Research supported by a grant (G-4212) from the National Institutes of Health, United States Public Health Service.

2. SOME PROBLEMS AND TECHNIQUES IN BIOLOGICAL C^{14} MEASUREMENT.

W. A. Peabody; *American Tobacco Company* and *Medical College of Virginia.*

Preparation of various classes of tissue and excreta for counting, and correction for natural potassium beta activity will be discussed briefly. Consideration also will be given to several types of counters as related to the requirements.

3. LIPIDS AND PIGMENTS IN THE MOTOR CORTEX OF HUMAN BRAINS AT VARIOUS AGES.

Robert H. Brownson; *Medical College of Virginia.*

Sections of superior precentral gyrus were removed from 15 essentially normal neurological specimens. The material consisted of one brain from each of the following years: 28 days, 3.5, 18, 25, 34, 38, 39, 40, 44, 50, 54, 55, 56, 76 and 89.

All tissues were fixed in 10 per cent calcium formalin and frozen sections cut at 10 micra. Sections were stained for lipids using the Sudan black B technique. Prior to staining with Sudan black B, controls were immersed overnight in a solution containing equal parts of ethyl alcohol and ether. The remaining frozen sections were impregnated with Del Rio-Hortega's ammoniacal silver carbonate solution for pigment.

Analysis of the human primary motor cortex indicated that lipid and pigment inclusions were present in varying amounts in both neurons and glial cells of all ages.

Pigment in neurons and glial cells demonstrated little or no consistent age change and the amount of pigment varied from trace to heavy deposits. It was noted, however, that there were evidences for consistent age changes in lipid distribution within neuron and glial cells. The quantitative amount of lipids appeared to increase with the increasing age of specimen.

4. THE EFFECT OF ACYLATION OF THE BIOLOGICAL ACTIVITY OF HYDRAZINO COMPOUNDS.

Herbert McKennis, Jr. and Jesse H. Weatherby; *Medical College of Virginia.*

Following the administration of hydrazine to rabbits there appears in the urine a minimum of two excretion products. One type responds immediately to acidic iodate with release of hydrazino nitrogen as nitrogen gas. Nitrogen is evolved from the other type only after hydrolysis. Although no metabolites of hydrazine have yet been isolated these findings suggest the presence of diacylated hydrazine in which both of the

nitrogens of hydrazine have been substituted. In consequence we were led to examine acylated derivaties for biological activity.

One of the probable metabolites of hydrazine is the monoacyl compound γ-glutamylhydrazide. Using a mixture of cofactors modified from Schou *et. al.*, it has been possible to show that simple aqueous extracts of acetone powers from liver (rabbit, and pigeon) and kidney (rabbit and hog) catalyze the uptake of hydrazine in the presence of glutamine. In common with hydrzine, γ-glutamylhydrazide, the probable product, causes elevation of blood ammonia in the dog. In collaboration with Dr. Allan S. Yard, we have found fatty livers in rabbits following single doses of γ-glutamylhydrazide.

5. EXPERIMENTAL MEDIAL HYPERTROPHY AND HYPERPLASIA OF CATS' PULMONARY ARTERIES.

J. F. Kell, Jr., G. E. Hennigar, and E. C. Hoff; *Medical College of Virginia.*

Pulmonary arterial medial hypertrophy and hyperplasia nd intimal proliferation or so-called endarteritis obliterans were produced in cats by chronic stimulation of suprasegmental centers of autonomic control. The stimulation of the brain was performed through the intact cranium with the electric shock apparatus and by repeated chronic parental adare produced by a combination of repeated pulmonary arterial and advanced changes including the intimal proliferation were produced by following the electrical shock stimulation with removal of twenty per cent of the estimated blood volume. It is suggested that these findings are produced by a combination of repeated pulmonary arterial and arteriolar vasoconstriction and massive engorgement of lesser circulation following a shift of the blood volume by extensive systemic vasoconstriction. These results suggest a hypothesis of the mechanism in one type of primary pulmonary hypertension.

6. INTEGRATION OF BLOOD PRESSURE RESPONSES IN DECEREBRATE ANIMALS.

T. R. Harvood, J. F. Kell, and E. C. Hoff; *Medical College of Virginia.*

It has been noted that some patients involved in accidents resulting in decerebrations showed blood pressure changes but all did not show similar changes. In an attempt to find out why there was variation and to try to find a center or centers that were involved in the blood pressure control above the medulla, various operative procedures were done on experimental animals to produce decerebrate preparations and the blood pressures recorded from the femoral artery, before, during and after the procedures.

Decerebrations below the tentorium caused no increase in blood pressure, but above the tentorium, there were transient rises in blood pressures after anesthesia (ether) had worn off. In these experiments, adequate and complete decerebrations did not lead to sustained hypertension.

7. STUDIES OF SOME PHYSIOLOGIC AND CLINICAL CONDITIONS ASSOCIATED WITH INCREASED FIBRINOLYTIC ACTIVITY OF THE BLOOD.

Susan J. Mellette and Louis A. Leone; *Medical College of Virginia.*

Increased fibrinolytic activity of the blood is associated with varying patterns of alteration in levels of the measurable components of the fibrinolytic enzyme system. Chronic low grade fibrinolysis, such as may occur in leukemia or carcinomatosis, is often characterized by low levels of profibrinolysis, proactivator, and antifibrinolysin. Conversely, an increase in net fibrinolytic activity with high profibrinolysin and rising tibrinogen may follow the administration of estrogens or of cortisone. Acute increases in fibrinolytic activity (secondary to exercise, surgical procedures, shock, etc.) are accompanied by changes in fibrinolytic enzyme components determined by the type, extent and duration of the stimulus.

That the fibrinolysis occurring occasionally in prostatic carcinoma is directly related to prostatic proteases is suggested by the demonstration that a marked increase in blood fibrinolytic activity, paralleling changes in serum acid phosphatase, may follow prostatic massage or manipulation. Furthermore, variations in individual rates of fibrinolysis as compared to fibrinogenolysis and in the inhibition produced by soybean trypsin inhibitor and by serum antiprotease also strongly suggest that more than one enzyme is responsible for the total fibrinolytic activity in any single case. Both qualitative and quantitative differences occur from time to time in the same patient as well as in different individuals.

8. PERTHANE (Q-137) ADMINISTRATION TO THE C3H MOUSE AND ITS EFFECT ON THE C3H/BA MAMMARY CARCINOMA.

L. A. Leone, Henry Hahn and Susan J. Mellette; *Medical College of Virginia.*

Perthane, (2,2-bis-(p-ethyphenyl)-1,1-dichloroethane), a DDT analogue, has caused adrenal cortical atrophy with insufficiency in dogs. Because of the known effect of adrenal ablative procedures in human breast carcinoma and the influence of ovarian and adrenal hormone in mouse mammary carcinoma, this study was carried out. C3H mice with and without transplanted BA mammary carcinoma were studied. Oral perthane administration caused significant body weight loss in the ab-

sence of decreased dietary intake or other obvious cause of food loss. It is possible that this effect may represent perthane influence on the adrenal gland in spite of the absence of histologic atrophy or hypertrophy. Subsequent stabilization of body weight occurs during continuing treatment to the point of toxicity at 20 days. The reason for this is not clear from these studies but this ability to "adapt" by weight stabilization may represent adrenal or "pituitary-adrenal" response. Body weight and tumor size studies suggest that weight loss can be accounted for primarily by loss of normal tissue rather than by destruction of tumor substance. Perthane has no significant growth-inhibiting effect on transferred mammary carcinoma in the C3H mouse as indicated by tumor size measurement and survival time.

9. THE INHIBITION OF AZO-DYE CARCINOGENESIS BY VARYING DIETARY LEVELS OF CERTAIN BENZIMIDAZFLES.

C. C. Clayton and L. D. Abbott, Jr.; *Medical College of Virginia.*

2,5 Dimethylbenzimidazole and 2-ethyl 5-methylbenzimidazole inhibit *in vitro* incorporation of N^{15} from N^{15}-glycine into heme by nucleated avian erthyrocytes (Va. Journ. Sci. *6*: 77, 1955), the multiplication of influenza virus (J. Exp. Med. 98: 245. 1953) and the development of liver tumors in rats when fed with the hepato-carcinogen 3′-methyl-4-dimethylaminoazobenzene (Federation Proc. *14*: 194, 1955). In our previous liver tumor experiments the benzimidazole derivatives were fed at 0.5% level for the 16 week duration of the experiment and afforded complete protection. In most of the present studies a purified diet containing 0.064% 3′-methyl-4-dimenthylaminoazobenzene was fed for 8 weeks after which the diet without the dye was continued for another 8 weeks. The benzimidazoles were fed only during the first 8 week period (with the dye) at dietary concentrations of 0.5, 0.25, or 0.1%. The two higher levels of 2-ethyl-5-methylbenzimidazole completely prevented the development of liver tumors while the 0.1% level decreased the incidence to about half that of the animals not receiving the compound. The lower levels of 2,5-dimethylbenzimidazole also decreased the percentage of liver tumors but not as markedly as the 2-ethyl compound. 0.5 percent of unsubstituted benzimidazole afforded some protection while benzotriazole and 5-methylbenzotriazole at this level were ineffective. When the active benzimidazoles were fed at 0.5% for a 4 week period between the 4 week periods of dye feeding, they had no influence on the development of liver tumors.

10. EFFECTS OF PHYSICAL EXERCISE OF GROSS BODY COMPOSITION OF THE GUINEA PIG.

Grover C. Pitts; *University of Virginia.*

Thirty-three male guinea pigs were studied. Thirteen animals seden-

tary since birth were killed at eight months of age. An exercise group of 20 animals walked on a power-driven treadmill daily from weaning until eight months of age. Twelve of these were then killed and the other eight were retired to a sedentary regimen. The retired animals were then killed after varying intervals of retirement. All carcasses were separated by dissection into eleven gross components (heart, liver, kidneys, spleen, gut, CNS, skin, muscle, bone, adipose tissue and remainder). Fractions of fat, water and residue were determined on each component as well as on the entire carcass. This report is limited to changes observed in adipose tissue. Changes in both extractable fat and fat-free weight of the adipose tissue were followed. The latter datum reflects the mass of lipocytes available for fat storage. During the first five days of retirement, per cent of both fat and fat-free adipose tissue nearly doubled and then subsided to the previous levels by the tenth day of retirement. Subsequently, a slow, asymptotic rise in both components began and appeared to continue during 90 days of retirement. It seemed unlikely that the retired animals would ever reach levels of fatness and fat-free adipose tissue found in the animals which were sedentary throughout life. The sedentary group possessed more than twice as much fat and about 1.4 times as much fat-free adipose tissue as the exercised animals which were sacrificed before retirement.

11. HISTOCHEMICAL STUDIES ON THE EFFECTS OF CASTRATION AND ANDROGEN REPLACEMENT ON RAT EPIDIDYMIDES.

L. F. Cavazos; *Medical College of Virginia.*

Sexually mature male rats were castrated and injected with the following levels of testosterone propionate in sesame oil (0.05 ml): 0, 12.5, 25, 50, 100, and 500 micragrams. Injections were commenced immediately after gonadectomy and continued daily for 20 days. Epididymides were fixed in Orth's, acetic alcohol formalin, Zenker's, and Bouin's. Staining reactions employed included: the periodic acid-Schiff technique, toluidine blue, Lillie's azure A-Eosin B, alcian blue with chlorantine fast red, and the Feulgen reaction.

In epididymides from intact rats, there was a weak reaction in the intertubular connective tissue and a stronger coloration of the basement membrane following the periodic acid-Schiff technique. Epithelial cytoplasm was faintly stained, but demonstrated numerous reactive granules and vacuoles. Glycogen was noted in the epithelial cytoplasm of the middle caput. Stereocilia were positive. Castration resulted in epithelial cell height reduction and a strongly Schiff-positive basement membrane which appeared thickened. Following the toluidine blue and azure A-Eosin B techniques, an intense basophilia, which was removed by ribonuclease, was noted in the perinuclear cytoplasm of epididymides from intact rats. In some cases, metachromatic material was dispersed

among the stereocilia and spermatozoa. Cytoplasmic basophilia was reduced or absent in castrate epididymides, but present in hormone-treated castrates.

12. THE EFFECT OF THERMAL INJURY, OPERATIVE STRESS AND HYPOPHYSECTOMY ON THE METABOLIC ACTIVITY OF THE PINEAL GLAND THE PITUITARY AND THE ADRENAL GLAND AS MEASURED BY P^{32}-UPTAKE IN THE ADULT MALE RAT. A PRELIMINARY REPORT.

O. J. Malm and O. E. Skaug; *Medical College of Virginia.*

The effect on the P^{32}-uptake of 20 different tissues has been studied two and a half hours after intraperitoneal injection in normal adult rats, and following a 15 per cent full-thickness burn and after sham-pinealectomy. The most striking finding is the marked and statistically significant fall in the relative specific activity of the pineal gland at four and a half hours after burn and sham-operation (reference: pooled brain tissue spec. activity = 100). The metabolic activity, measured by the two and a exceeded by the liver. The high uptake of the pineal gland, only exceeded by the liver. The high uptake of the pineal gland is nearly restored at 17 and 48 hours after traumatic stress.

In adult rats hypophysectomized two to three weeks prior to the uptake study, the rel. spec. activity of the pineal is not significantly altered from that of normal controls, while the adrenal cortical and thyroid activities are markedly reduced. Cortisol injection, .25 mg. daily for two days, increased the pineal activity, without altering the uptake of other tissues. Administration of a purified growth hormone preparation (Somacton), 3.3 Tibia units daily for four days, increased the relative specific activity of the pineal gland to values exceeding those of both hypophysectomized and normal controls.

13. ALTERATIONS IN CASEIN BY EXPOSURE TO ETHYLENE OXIDES.

Herbert G. Windmueller, Clemens J. Ackerman, and Ruben W. Engel; *Virginia Agricultural Experiment Station, Blacksburg.*

The exposure of vitamin-free casein to gaseous ethylene oxide for 24 hours so alters the protein that when it is fed to weanling albino rats as the sole nitrogen source they fail to grow. This growth *inhibition* is reversed as soon as untreated casein is substituted in the diet or when the treated diet is supplemented with methionine and histidine. The uptake of ethylene oxide by casein is followed by the Warburg manometric technique. When individual amino acids are so tested, only cysteine.HCl shows a rapid uptake, resulting in a compound lethal to weanling rats when injected subcutaneously. The LD_{50} of this unidentified compound is 13 mg. of treated cysteine-HCl per 50 gm. body weight. Cysteine (free base) does not undergo this reaction. Electrophoretically, casein exhibits

a decrease in mobility following treatment with the gas. Addition of the gas to active sites on the protein is indicated by a decrease in Kjeldahl nitrogen of 1.4% following prolonged ethylene oxide treatment. The ability of pepsin or trypsin to hydrolyze ethylene-oxide treated casein is apparently not impaired.

14. THE EFFECT OF NUCLEOSIDES ON PHOSPHATE TRANSFER IN HUMAN ERYTHROCYTE GHOSTS.

D. R. H. Gourley; *University of Virginia School of Medicine.*

By hemolyzing human erythrocytes in the presence of a given nucleoside and subsequently restoring the isotonicity of the medium with sodium chloride, it is possible to prepare cells containing large amounts of the nucleoside. With this technique cells can be prepared to contain, for example, 5-8 times the original concentration of adenosine. Since cells prepared in this way lose their ability to utilize glucose and contain only about 60% of the original hemoglobin concentration, they are referred to as "ghosts." In addition to the nucleosides adenosine, xanthosine, guanosine, and cytidine, ghosts containing large amounts of adenosine triphosphate, adenosine monophosphate and ribose-5-phosphate have also been prepared. During subsequent incubation at 37°C. the nucleosides leave the ghosts until the concentrations in the ghosts and medium are equal. However, the phosphorylated compounds remain largely in the ghosts suggesting that the membrane of the ghost is impermeable to phosphorylated compounds. All of the above-mentioned compounds will support the active uptake of P^{32}-labeled orthophosphate by the ghosts with the exception of cytidine. Since ribose-5-phosphate (but not free ribose) also provides the necessary energy for phosphate ion transfer, these results suggest the presence of an enzyme in the ghosts which promotes phosphorolysis of the purine nucleosides with the production of ribose phosphate.

15. PHOSPHATE UPTAKE IN THE ERYTHROCYTES OF HUMAN BLOOD HEATED *in vitro*.

Ralph A. Natwig and Odvar E. Skaug; *Medical College of Virginia.*

Previous work indicates a deleterious effect of heat, both *in vivo* and *in vitro*, on the glycolytic activity of erthyrocytes. In the present study P^{32}-uptake during four hours of incubation at 37°C. has been used as an indicator of the glycolytic activity of human erythrocytes heated *in vitro* to 48°, 51°, 53° and 55°C. for 3 minutes. The mean uptake after four hours in erythrocytes from 35 normal individuals was 15.7% ± 1.0 per 0.1 ml. red blood cells of the P^{32}-dose added to 1 ml. blood. Heating for 3 minutes at 48°C. caused no significant decrease in uptake of P^{32}. A significant decrease in phosphate incorporation was observed in the

erythrocytes of blood heated to 51°, 53° and 55°C., the uptake after four hours amounting to 92%, 89% and 80% respectively, as compared to the unheated controls. These results add further evidence to the existing data indicating a detrimental effect of heat on the glycolytic activity of red cells. A relationship is suggested between the reduction in glycolytic activity and the previously reported morphological changes, increased fragility and hemolysis of red cells subjected to heat.

16. THE TRANSFER OF ENERGY FROM P-TERPHENYL TO RIBOFLAVIN.

Chalmers L. Gemmill; *University of Virginia.*

In order to study the transfer of excitation energy to molecules of biological interest, the Beckman DK-1 was modified in order to record automatically the fluorescent spectra. Various concentrations of phosphors were used in this study with this instrument. When p-terphenyl and alpha-naphthyl phenyloxazole (ANPO) were used in toluene, there was a marked reduction of the fluorescence of p-terphenyl and an increase in the fluorescence of ANPO. Similar results were obtained with p-terphenyl and diphenylhexatriene and with 2,5-diphenyloxazole and 1,4-di-2(5-phenyl-oxazolyl) benzene. When various amounts of riboflavin were combined with p-terphenyl in a water-dioxane solvent, there was a reduction of the fluorescence of the riboflavin. These results indicate that riboflavin may accept the energy from the p-terphenyl on excitation of this molecule by ultraviolet light. In all cases the exciting light was held constant.

17. RYANODINE INDUCED CONTRACTURES IN FROG SKELETAL MUSCLE.

Mary Frances Arrighi and Robert W. Ramsey; *Medical College of Virginia.*

The alkaloid ryanodine induces some very profound changes in the metabolism and mechanical properties of frog skeletal muscles. Edwards and Flinker have shown that ryanodine induces an enormous consumption of oxygen provided the unrestrained muscle does not shorten to a length less than 40% of its rest length. With further shortening to 30% of rest length, there is a rapid and complete cut off of this excess oxygen consumption induced by ryanodine. It will be shown that in ryanodine induced contractures where the final length is less than 40% of rest length, there is a large and progressive synuresis of water until the maximum shortening is achieved (final length 13% of rest length). The process is irreversible and has a Q_{10} of 8.6 indicating most probably a denaturation process. The results are interpreted in terms of a recent analysis by one of us that showed muscle statistically behaves like some high polymers discussed by chemists.

18. PSYCHE AND THE HUMAN UTERUS.

William Bickers; *Medical Arts Building, Richmond, Virginia.*

A technic for recording human nongravid uterine contractions employing the principle of the stress gauge is described. The normal pattern of human uterine contractions at various stages of the menstrual cycle is illustrated. It has been shown that certain psychic stimuli in hyper-susceptible women is followed by immediate increase in tone of the uterus and an altered pattern of myometrial contractions. This prompt response on the part of uterine muscles to psychic stimuli must be explained on a neurogenic basis since the time interval between stimulus and response is too short to be mediated through a humoral mechanism. The clinical opinion long held that psychic disturbances affect uterine physiology has been shown to have a valid basis in demonstrable physiologic changes which occur in the human uterus in the wake of fear and anxiety. The significance of these observations as they relate to obstetrical and gynecologic disorders is emphasized.

19. TOXICITY STUDIES ON SALICYLAMIDE IN MAN.

Reno Porter and Allan L. Forbes, *Medical College of Virginia.*

Twelve thousand, six hundred and twenty-six grams of salicylamide, the amide of salicylic acid, were administered to 13 patients in 1,079 patient days, with an average daily dose of 12.0 gm. Seven patients had rheumatoid arthritis, five acute rheumatic fever, and one congenital heart disease. The average daily doses for each patient varied from 5.2 gm. to 19.7 gm., and the duration of therapy varied from 9 to 192 days. The maximum total dose to a single patient was 3,582 gm. in 182 days, with an average of 19.7 gm. per day. One patient developed an acute febrile reaction and a rash secondary to the drug. In the remaining patients, side effects were absent, or mild, the most common being "lightheadedness"; gastric distress was noticeably absent. No significant change occurred in the white blood cell counts or in the prothrombin concentration; there was a tendency for the prothrombin concentration to rise, rather than to fall. None of the manifestations of salicylism occurred. The clinical impression of the therapeutic effect of salicylamide as an anti-inflammatory drug was distinctly promising, similar or superior to what would be expected from therapy with aspirin or sodium salicylate in non-toxic doses. The low incidence of toxic reactions to salicylamide in very large doses as compared with aspirin and sodium salicylate seems established.

20. USE OF ANTI-RH SERA FOR DEMONSTRATING THE AGGLUTINATION ACTIVATING FACTOR IN RHEUMATOID ARTHRITIS.

Marion V. Waller and John H. Vaughan; *Medical College of Virginia.*

Certain high titered anti-Rh sera may be used to sensitize human Rh-positive red cells for the demonstration of the Agglutination Activating Factor (AAF) of rheumatoid arthritic sera. Parallel studies of rheumatoid sera using the sensitized sheep cell technic and the sensitized Rh-positive red cell technic showed comparable titers. Lack of complete correlation suggests the possibility of a multicomponent system for AAF, consisting either of multiple antibodies or of a single antibody with multiple cross specificities. The fact that there exists a suitable immune system, involving only antibodies and antigens of human origin for the demonstration of AAF is of interest in terms of the possible significance of this factor in the production of the disease process, rheumatoid arthritis.

21. PLASTIC PROSTHETICS IN THE POST-SURGICAL CARE OF DIABETIC GANGRENE. A PRELIMINARY REPORT.

Albert Pincus, Milton Cummins, Ted Levy, William Bricker, and Stanley Bricker; *Medical College of Virginia Hospitals and Out-Patient Clinics.*

The dynamic application of a plastic material to replace a missing toe is a procedure relatively new in medicine. It is our purpose to present our method of rehabilitating the diabetic foot by preventing the deformation of the toes adjacent to the amputation. The deformities most commonly seen by the chiropodist in the diabetic clinic in patients with toe amputations are hallux valgus with infected bunion, the hammer-toe and the overlapping toe with infected corns. If we can see the patient soon after surgery we have been able to keep the adjacent toes from deforming. We accomplish this by using a flexible acrylic resin in the space of the missing digit. The resin is mixed and prepared in a few minutes, molded into the area, covered with a vinyl sheeting and with the shoe on the foot the patient is permitted to walk. The plastic is hydraulically responsive in this state, thereby molding exactly between the toes and under the toe webbing. This usually takes from 2-5 minutes depending on the environmental temperature. The plastic resin is then separated from between and under the toes and permitted to cure at room temperature for 24 hours. The margins are then ground down to a feather edge and fitted to the part. This type of toe prosthetic acts as a buttress to forcibly pry apart toes that previously would deform into hammer-toes and bunions with resultant infections and ulcerations so commonly seen on the diabetic foot.

22. LIPID CONCENTRATION OF HUMAN ADRENALS WITH PARTICULAR REFERENCE TO HYPERTENSIVE DISEASE.

Cornelia Hoch-Ligetti, Karen Irvine, James E. Irvine; *University of Virginia.*

Adrenals from 210 unselected autopsies were analyzed for cholesterol,

phospholipid and total lipid concentration; heart, kidneys, liver and blood of 41 cases were similarly studied. The data were correlated with the disease, cause of death, degree of arteriosclerosis and weights of the organs. The average concentration of cholesterol, total lipids, and dry weights of adrenals were significantly increased in patients dying with compensated hypertensive cardiovascular disease, and with persons who committed suicide. These values were significantly decreased in cases of malignancy, active infections and chronic degenerative diseases. The changes in lipid concentration in the various diseases were restricted to the adrenals. No correlation was found between adrenal and blood cholesterol concentration or between adrenal lipid concentration and degree of arteriosclerosis. The adrenal phospholipid concentrations were significantly increased with malignancy, active infections and degenerative diseases when calculated on dry-weight basis. On histological investigation the adrenals in hypertensives showed increase of lipid content in the zona fasciculata and increased number of brown pigment containing cells in the reticularis.

23. RENAL FUNCTION IN MAN AND DOGS RENDERED POLYCYTHEMIC BY OXYGEN TENSION.

E. Lowell Becker; *Medical College of Virginia.*

Studies of renal function were made on five normal men native to an altitude of 14,900 feet. Glomerural filtration rates and effective renal plasma flow were determined by the constant infusion technique using insulin and p-aminohippurate. All subjects showed a statistically significant decrease in filtration rate, effective renal plasma flow and effective renal blood flow, with an increase in hematocrit and filtration fraction.

Studies were carried out at sea level on three dogs rendered polycythemic by exposure to low oxygen tension (8%) for a period of two years in a decompression chamber.

The filtration rate and effective renal plasma flow were decreased and the effective renal blood flow and filtration fraction were increased, as compared with control observations on five normal dogs, and with other data recorded in the literature.

$T^{c}_{H_2O}$, The concentrating capacity of the experimental dogs as measured by H_2O, was substantially lower in the polycythemic dogs than in our controls and lower than in other dogs reported in the literature.

24. THE PELGER-HUETT ANOMALY IN A NEGRO FAMILY.

Jonas C. Strouth and Roscoe D. Hughes; *Medical College of Virginia.*

The first case of Pelger-Huett anomaly in an United States Negro

family is reported. This anomaly is inherited as an autosomal dominant with 100% penetrance, and has virtually invariable expressivity. Its potential clinical significance, incidence in the population, and importance in autosomal linkage studies are discussed.

25. SCHULTZE'S PICTURE IN THE BOVINE COLON.

James R. Rooney; *Animal Pathology*.

This study was designed to elucidate the occurrence and nature of a thickened area in the mucosa of the bovine colon. Two such thickened areas were found to occur normally in all colons examined. The thickening was caused by accumulations of lymphoid tissue in a Peyer's patch-type of arrangement. Microscopically, the crypts of Lieberkuhn were found to penetrate into the submucosa in these lymphoid areas, apparently as a result of defects in the muscularis mucosae. Pathological changes were frequently noted in these areas. The submucosal crypts of Lieberkuhn, particularly, were subject to cystic, abscessing changes. This type of lesion was found to be specific for the glands themselves and not for any particular disease entity.

MINUTES OF THE SECTION OF PSYCHOLOGY (10)

FRANK W. FINGER, *Chairman*
ROBERT FILER, *Secretary-Treasurer*
NOBLE MCEWEN, *Executive Committeeman*
RICHARD H. HENNEMAN, *Section Editor*

FRIDAY, MAY 11, 1956—2:00 P. M.—LITTLE THEATER

1. THE EFFECT OF CERTAIN SENSORY STIMULATION ON THE PERCEPTION OF A LONG TIME INTERVAL.

Patricia Ann Rund; *College of William and Mary.*

The study was undertaken to determine whether annoying auditory, visual, or cutaneous stimulation affected the perception of a long time interval. Twelve female subjects were used. Each was presented with four conditions in a counter-balanced order: I—control; II—loud noise; III—flickering light; and IV—tickle. S was asked to indicate was pressing a key when she felt that a five-minute interval had passed. This judgment was made on four consecutive intervals. Experimental sessions varied in length from 20 to 35 minutes for each condition. Subjects' estimates under the three experimental conditions were about 20% less than those under the control condition. Estimates under Condition III (flickering light) may be slightly less than those under the experimental conditions; however, since no error had been made to equate intensities of the three experimental variables, no conclusions are drawn from this aspect of the results. These results place in a different light a study by Smith, Wing, and Jerison on "The Effect of Acoustic Noise on Time Judgment". They interpret similar data in terms of a hypothesis about central neural mechanisms of audition. Since the present study indicates that the stimulation of sensory systems other than audition can produce about the same effects, doubt is cast on any purely auditory explanation.

2. SKIN TEMPERATURE EFFECTS ON VIBRATORY THRESHOLDS.

Glenn R. Hawks; *University of Virginia.*

The effect of warming and cooling the skin on vibratory thresholds has been reported by Weitz (1941). Using a mechanical stimulator, he obtained an initial lowering of thresholds, followed by a rise as temperature was increased; with lowered temperatures there was a considerable heightening of threshold. Subsequently he showed that sensations pro-

duced by electrical stimulation of the skin were similarly influenced by temperature changes. Recent work by the author and others in the Virginia Laboratory on this problem has utilized 1,000-cycle sinusoidal alternating current, both slowly rising to threshold, and in short pulses which permit a determination of threshold by the Method of Limits. Results thus far indicate a usual but not invariable heightening of threshold with lowered skin temperature. No reliable effect from raised temperatures has been obtained. Present work is attempting to find small "spots" on the skin surface where sensitivity is both reliable and high in relation to immediately surrounding areas.

3. AN EXPERIMENTAL STUDY OF VIBROTACTILE APPARENT MOTION.

William H. Sumby; *University of Virginia.*

The purpose of the research reported was to determine the optimal vibrotactile stimulus conditions for the arousal of apparent tactual movement. The variables manipulated were the intensity of vibration, the temporal interval between stimulations, and the spatial separation between transducers. The frequency of vibration was held constant as was the general cutaneous area stimulated, the thoracic area of the back. By simultaneously manipulating the independent variables 81 different stimulus patterns were available. Each stimulus complex was delivered 5 times to each of 5 Ss, or 2025 stimulus presentations. The results demonstrate quite conclusively that the optimum temporal interval between bursts lies beween 80 and 120 milliseconds of stimulus overlap regardless of the intensity or spatial separation used. In other words, it is quite apparent that the spatial separation and the intensitive variable are not as critical as the temporal interval. Analysis, however, does not reveal any consistent general relationships existing among the stimulus properties which might be interpreted as suggesting the vibrotactile analogues of Krote's laws for visual apparent motion.

4. TRAINING ON A VIBRATORY COMMUNICATION SYSTEM.

William C. Howell; *University of Virginia.*

The purpose of this study was to develop a practical communication system utilizing three dimensions of vibratory stimulation: location, amplitude, and duration. The language elements to be encoded were letters of the alphabet and digits. The 36 discrete stimulus patterns necessary to encode these elements were selected on the basis of preliminary investigations; five loci, three durations, and three intensities of stimulation constituting a satisfactory arrangement. Assignment of language elements to these patterns was carried out in a manner calculated to enhance speed and accuracy. Three subjects were trained to receive information utilizing this system. Training consisted of 25 double presentations of the alphabet in random order, 25 single presentations of 52-

letter lists, and a number of words and short messages. All subjects attained a high degree of accuracy which was maintained throughout the rest of the training period. Retention after several months was almost perfect. Limitations imposed by the equipment, however, rendered impossible the determination of the maximum speed of reception. Therefore, the apparatus was modified and a new training series undertaken to resolve this question. Results indicate that the vibratory communication system may be expected to compete successfully with the international Morse Code in terms of both accuracy and speed of reception.

5. A COMPARATIVE PERSONALITY STUDY OF A GROUP OF STUTTERERS AND HARD OF HEARING PATIENTS.

Reuben S. Horlick; *Audiology and Speech Center, Walter Reed Army Medical Center.*

The purpose of this study is to investigate the personality structure of and compare the differences between two groups of Army and Air Force patients referred to the Audiology and Speech Cented for evaluation of and therapy for stuttering or impaired hearing. Two groups of twenty patients each were administered the California Test of Personality and the results compared for statistical significance. The test was administered prior to initiation of therapy and rehabilitation. A third group of medical technicians was used as a control group. Although the difference was not statistically significant, the findings suggest that the stutterers, as a group, tend to manifest more nervous symptoms, greater tensions, feelings of inferiority and insecurity, and withdrawal symptoms. On the other hand, the personality picture of the hard of hearing is more like that of the control group. The results do not justify the often expressed depressing view of the hard of hearing. A detailed report will be given.

6. LANGUAGE BEHAVIOR IN THE MENTALLY RETARDED.

Henry Winthrop; *Hollins College.*

A series of studies of the language behavior of the mentally retarded has been undertaken in terms of the Ammons FRPVT. Some of the results are indicated here. The relative abilities of a large sample of mental defectives were contrasted for abstract and concrete words. Failures and successes within concrete terms were compared, as well as failures and successes within abstract terms. A breakdown of successes and failures by parts of speech has been made, within the abstract and concrete categories. Correlations have been obtained between IQ and MA on the one hand and successes in abstract and concrete terms, on the other. Significant differences in the comprehension of different parts of speech within the abstract and concrete categories have been ex-

plored. Contrasting language abilities of idiopathic, familial and organic brain damaged defectives have been analyzed.

7. CRITICAL FACTORS IN THE ACADEMIC ACCELERATION OF GIFTED CHILDREN BASED ON CLINICAL DATA.

Antonia Bell Morgan; *Aptitude Associates Incorporated.*

Recent research in the field of gifted children has been largely clinical, or idiographic, rather than statistical or nomothetic. The chief value of idiography lies in the delineation of new variables and working hypotheses which may then be subjected to testing by the nomothetic approach. (See Falk, Psychological Review, 63, 1, 53-62.) Psychologists are practically unanimous in agreeing with Terman that academic acceleration of at least one year is very desirable for gifted children, provided that it takes place on an individual basis after due consideration of all the factors involved. The following six factors are hypothesized as critical for the success of accelerations: 1. Physical maturity; 2. Social maturity; 3. Emotional maturity; 4. Academic achievement; 5. Attitude of the teacher; and 6. Attitude of the parents.

These factors are discussed with reference to 21 clinical cases. Criteria for successful acceleration are suggested as hypotheses for experimental investigation.

8. THE RAT'S ADJUSTMENT TO 23-HOUR FOOD-DEPRIVATION CYCLES

Marvin H. Weasner; *University of Virginia.*

Animal experimenters who have utilized extended deprivation cycles have usually assumed that a preliminary adjustment period of 5 to 10 days is sufficient before placing the animal into the experiment proper.

This experiment is designed to yield information on the methodological question: How long must a rat be maintained on a 23-hour food-deprivation schedule for the various indices of drive to approximate their symptotic values? In this study the measured indicators of drive are body weight, amount of food and water ingested, 24-hour activity, and activity driving the last daily prefeeding hours.

Activity is measured by the number of the rat's interruptions of an infra-red light beam which bisects the long dimension of the rat's home cage and which falls upon a photoelectric cell on the opposite side.

Comparison of the eight-animal experimental group data with that of the matched control group indicates that the functions of the various drive indicants are not parallel, that body weight is still decreasing, and activity in the last prefeeding hour is still increasing at the end of 30 days of this deprivation schedule.

The data suggest that a 30-day adjustment period is too brief to permit certain indices of drive to level off.

9. FACTORS INFLUENCING COMPLEX TASK PERFORMANCE.

Milton H. Hodge; *University of Virginia.*

It is assumed (1) that there is a class of variables characteristic of simple response situations, (2) that these variables are also present in complex response situations, (3) that there is another class of variables unique to complex response situations, and (4) that in complex task situations there exists the possibility for an interaction between these classes of variables. From these assumptions it can be predicted that certain values of the first class of variables maximize performance in simple response situations. This prediction is similar to Fitts' concept of stimulus-response compatibility, *i.e.*, some responses are easier to make to certain stimuli than are other responses. It is further hypothesized that use of the same values of the simple response variables in a complex response situation may lead to a decrement in performance, the decrement being a result of the interaction between the two classes of variables. An experiment is proposed to test the hypothesis that performance decrement in a complex response situation can result from an interaction between these variables.

10 REINFORCEMENT AND COMPLEX VERBAL BEHAVIOR.

William E. Montague; *University of Virginia.*

Reinforcement has been shown to be powerful in the control of much behavior. With some behavior, however, the psychologist finds it difficult, at least in complex behavior, to adequately specify and measure the response which is being reinforced. Especially, as the complexity of verbal behavior increases it becomes more difficult to define responses and to bring them under the control of reinforcement. If the probability of a response is to be varied lawfully through the use of such a variable as reinforcement, the response must be clearly specified. In a simple verbal conditioning study reported last year, a high correlation existed between verbal responses being conditioned and the manual responses being measured. This was demonstrated to be the case because the verbal responses were brought under the control of reinforcement. Later work using a similar but more complex situation failed to show such results. This paper attempts to demonstrate that these results were due to ambiguity of the reinforcement with respect to the verbal response and that if the response is clearly specified it can be brought under the control of reinforcement.

11. CONDITIONS DETERMINING THE EFFICIENCY OF MULTIPLE TASK PERFORMANCE.

John Bennett Feallock; *University of Virginia.*

The present experiment is one of a series investigating the conditions

determining the efficiency of multiple task performance. In multiple task performance the subject moves from one task, or set of inter-related responses, to another in varying orders. The characteristics of multiple task performance would seem to involve variables related to discrimination and retention processes as well as the effects of shifting from one task to another. The first three experiments in this series indicated that both the order in which the subject performed the task and the degree to which retention was involved in the task were important behavioral determiners. The present experiment, like the previous three, utilized card-sorting technique. The variables manipulated were (1) similarity of the figures on the cards, (2) uncertainty, or the degree to which they were ordered in the deck, and (3) retention of the characteristics of previous cards. Time and error scores were obtained from thirty-two subjects in a 4 x 4 x 2 factorial design. Analysis of variance indicated that both similarity and retention were significant factors. These results are discussed in light of the three previous experiments.

12. ACADEMIC SUCCESS OF PUBLIC AND PRIVATE SCHOOL STUDENTS IN COLLEGE; I. THE FRESHMAN YEAR.

Audrey M. Shuey; *Randolph-Macon Woman's College.*

In comparing academic achievement during the freshman year of 189 pairs of students at Randolph-Macon Woman's College, we found the public school students to have made significantly higher grades on the average, than the students from private schools of the same age, intelligence, and academic load, from the same section of the country and from communities of similar size. Students from private schools appear to have participated with more distinction in athletics; however, there were no significant differences found in extra-curricular participation (excluding athletics), in fraternity membership, or in leadership. Our two groups did not differ significantly in academic motivation in so far as it depends upon such factors as: number of siblings, religious preference, education of parents, and state of home (whether broken or unbroken). It would seem, therefore, that neither motivation, extra-curricular participation in general, nor leadership activity would account for the differences obtained; nor was differential selectivity or the type of preparatory school attended found to be primarily responsible for the higher average attained by the public school students.

13 AN INVESTIGATION OF SEVERAL METHODS OF TEACHING CONTOUR INTERPRETATION.

F. J. McGuigan; *Hollins College.*

Two companies of 162 Army Basic Trainees, each trained by the use of various combinations of concrete or abstract representations of terrain (a terrain board, two-dimensional slides and three-dimensional slides of

the terrain), and concrete or abstract symbols (contour lines on two-dimensional or three-dimensional maps) were observed. Learning resulting from these methods was compared to the Standard Army method, and a No-training (control) condition. The results showed that the training method involving representation of terrain by two-dimensional slides, and presenting the symbol on a three-dimensional map generally led to highest proficiency. In particular it is significantly superior to the Standard Army method. No definite conclusion was possible regarding condition two above, although one possible interpretation is that variation of the representation of terrain along an abstract-concrete dimension does affect learning. The data also suggest that the symbol should be of a relatively concrete nature. In addition, it was found that Pattern Analysis scores of the Army Classification Battery were highly related to contour interpretation proficiency ($r = .86$ to $.94$), and Ss with high Pattern Analysis scores learn contour interpretation significantly better than lower aptitude Ss.

14. MENTAL HYGIENE'S CHALLENGE TO EDUCATION.

John A. Blake; *Central State Hospital, Petersburg.*

Although the amount of mental illness is increasing annually, as shown by first admissions to mental hospitals, it can be shown how the public school and kindergarten teachers, with proper training and motivation, can very effectively assist in stemming the tide in a few years and even actually reverse the trend eventually. First, statistics are presented to indicate the following: (a) amount of mental illness in the country; (b) the annual rate of increase; (c) the per cent of psychogenic disorders, which are known to start developing during the school years. Second, statistics are presented from over 140 Teachers Colleges and University Departments of Education, which train teachers, to determine two facts: (a) the number and kinds of psychology courses provided for teachers-in-training; and (b) to what extent these teacher-students are not only specifically trained to identify the earliest signs of potential future personality disorder in school children, but also have such a duty formally set forth as an avowed goal in which they would refer such questionable cases to the proper authorities immediately for further appropriate handling. Finally, ways and means are discussed, and possible objections are raised and answered.

BUSINESS MEETING

The business meeting was opened by the Chairman at 7:30 P. M. The Secretary-Treasurer reported a membership of 101 and receipts of $361.00; of this money, $245.00 was disbursed to the Treasurer of the Academy, $41.00 to the Treasurer of the Conference of State Psychological Associations, $20.44 to the Chairman of the Psychological Section,

and $54.56 to the Chairman of the Committee on Constitution.

Announcement was made of the appointment of Dr. Reuben Horlick as representative to C.S.P.A. and of Dr. Gilbert Rich as alternate; of Dr. Cyril Mill as member of the Examining Board for Clinical Psychologists for a five-year period, succeeding Mrs. Catherine Giblette; of the following members as making up the Committee on Constitution: Dr. William Morgan (Chairman), Dr. Richard Henneman, Dr. Horlick, Dr. Jacob Silverberg, Dr. Stanley Williams, and Dr. Rich (*ex officio*). The following were appointed as members of the Committee on Professional Ethics: Dr. Arthur Bachrach (Chairman), Dr. Kenneth Lloyd, Dr. Hiram Gordon, Dr. Merton Carver, and Dr. Mill.

The Chairman announced that the Section program has been lengthened to one and one-half days, and that a dinner had been included to precede the business meeting. Dr. Horlick reported that the Conference of State Psychological Associations was concerned with 1) public relations, 2) certification, 3) professional ethics, and 4) internal organization of the Conference of State Associations.

The report of the Nominating Committee was presented and the following persons were elected officers for the coming year:

Chairman, Dr. Frank Finger; *Secretary-Treasurer,* Dr. Robert Filer; and *Executive Committeeman,* Dr. Noble McEwen.

Dr. Morgan gave a report of the Committee on Constitution. The following motion was made and carried unanimously: I move that the Psychology Section of the Virginia Academy of Science approve and sponsor a Virginia Psychological Association and that a meeting be held immediately after adjournment to organize such an association.

The meeting was adjourned at 9 P. M.

MINUTES OF THE SECTION OF SCIENCE TEACHERS

FRANKLIN D. KIZER, *Chairman*
SAMUELLA CRIMM, *Chairman-Elect*
MARTHA W. DUKE, *Secretary*
CAROLINE GAMBRILL, *Section Editor*

FRIDAY, MAY 11, 1956—8:30 A. M.—BALLROOM, HOTEL JEFFERSON

1. BUSINESS MEETING.

Mr. Kizer appointed Mr. A. B. Niemeyer, Jr., chairman of the nominating committee. The following slate was presented: *Chairman-Elect*, Vera Remsburg, and *Secretary*, Martha W. Duke. As there were no nominations from the floor, these officers were declared elected.

2. RECENT TRENDS IN PLANT SCIENCE WORK AT THE BLANDY EXPERIMENTAL FARM.

Walter S. Flory, Jr.; *University of Virginia.*

The White Arboretum comprises about 130 acres of land on which are found some 13,000 accessions, and a total of about 5,000 plant species. Some of the larger collections include Pines, other Conifers, Oaks, Iris, Oleaceae (Ash family), Rosaceae, Box and Hollies. Kodachromes of the Arboretum were shown. Contemplated initial experiments to be carried out in the planned Cobalt-60 radiation field were described.

Well advanced studies by different members of the Blandy group include: (1) Corn genetic investigations including detailed meiotic surveys of both treated and untreated materials; (2) a cytotaxonomic and phylogenetic survey of certain araceous genera; (3) collections and work in connection with a revision of eastern American roses; (4) an investigation of the confusing *Ipomoea* complex encountered in the morning-glories and their relatives; and (5) detailed chromosome studies in connection with the larger problem of phylogeny and evolution in the Amaryllidaceae. Findings and conclusions from these and other projects were summarized.

3. RECENT TRENDS IN MEDICAL GENETICS.

Roscoe D. Hughes; *Medical College of Virginia.*

The knowledge that certain anomalies are inherited antedate both

Mendelian genetics and the art and science of modern medicine, Hemophilia, certain types of dwarfing, and albinism are only three of many such examples which might be given. Since the turn of this century scores of man's ancient maladies have been subjected to genetic analyses with the result that their mode of transmission from generation to generation by certain genes is known. The elucidation of the precise genetic mechanism predisposing an individual to a disease is an important advance in medical genetics in itself. When the exact mechanism is known it is no longer necessary for a practitioner to use such vague terms as "congenital" and "familial." Diseases which are "familial" or "congenital' of course may or may not be inherited, and such labels, when inherited is intended, may be more misleading than useful.

When we know how a disease is transmitted through the germplasm, one important aspect of its etiology is solved.

Perhaps the most significant recent trend in medical genetics is in the field of research. In this area team work among medical scientists and geneticists promises to pay huge dividends in the future. Medical science has been able for decades to deal a telling blow to a large number of infectious, exogenous diseases. Attention is more and more being directed at degenerative diseases having an endogenous origin. Many, if not most, of such diseases have a genetic basis, known sometimes precisely, and other times strongly indicated. Many of the blood anomalies and ectodermal dysplasias fall in this category. The team work of scientists from several disciplines, including genetics, will be necessary to mount the desired massive frontal attack on these ubiquitous and perplexing diseases.

4. THE TRANSPORT OF SOUND BY WIND.

Edwin F. Ford; *Wakefield High School, Arlington, Virginia.*

The problem of the motion of an individual sand grain in wind is subjected to a physical-mathematical analysis.

At the surface of the ground on a windy day the air is not moving. As height above the ground increases, the wind velocity increases rapidly approaching a limiting velocity at approximately one to three feet. Four principal forces act on a sand grain suspended in this wind velocity gradient: the horizontal viscous drag, which tends to reduce the relative velocity between the air and the sand grain to zero; the vertical viscous drag; the aerodynamic lift, which is found by two different theoretical methods to be proportional to the difference in the square of the wind velocities at the top and bottom of the sand grain; and the force of gravity. On the basis of the above analysis differential equations are set up expressing the vertical and horizontal accelerations of the sand grain as functions of the position and velocity of the grain. A theoretical

trajectory is calculated for an average sand grain in an experimental wind profile obtained in a homemade wind tunnel. The actual paths of sand grains in the same wind tunnel profile were photographed. The observed trajectories agree fairly well with those calculated.

MINUTES OF THE SECTION OF STATISTICS (12)

M. C. K. TWEEDIE, *Chairman*
J. E. FREUND, *Vice-Chairman*
CLYDE Y. KRAMER, *Secretary*
LIONEL WEISS, *Section Editor*

FRIDAY AND SATURDAY, MAY 11, 12, 1956—ROOM 10, SECOND BAPTIST CHURCH HOUSE

1. THE COMPARISON OF THE SENSITIVITIES OF EXPERIMENTS USING DIFFERENT SCALES OF MEASUREMENT.

D. E. W. Schumann and R. A. Bradley; *University of Stellenbosch* and *Virginia Polytechnic Institute.*

This paper deals with a problem formulated by W. G. Cochran in a paper in the *Annals of Mathematical Statistics* (September 1953) on: "The Comparison of Different Scales of Measurement for Experimental Results." Assume two experiments (equal in size and design) with identical treatments, both depending on the analysis of variance and the scoring scales used. If real treatment differences exist, the more sensitive experiment or scoring scale will obviously be the one that best shows up the treatment differences, and a comparison of the sensitivities should be based on the variance ratios of the two experiments. Hence, in comparing two scales for more than two experimental treatments, we need a test of significance that two noncentral variance ratios (noncentral F's) are equal.

Considering the case of two noncentral F's, both with 2a and 2b degrees of freedom and with parameters of noncentrality λ_1 and λ_2 (where $\lambda = \frac{\Sigma t_i^2}{2\sigma^2}$, t_i being the *ith* treatment effect and σ^2 the error variance, in the usual additive model of analysis of variance), the distribution function of the ratio of two noncentral F's is obtained. Some properties of this function and methods of finding the probability integral, $\int_0^{w_0} f(w)dw$ are considered. The construction of tables of percentage points for use in tests of significance under the hypothesis that $_1 = {}_2$, i. e. the hypothesis of equal sensitivity of the two experiments is dealt with.

2. COMPONENTS OF VARIANCE FOR A TWO-WAY CLASSIFICATION WITH PROPORTIONAL FREQUENCIES.

R. E. Walpole; *Virginia Polytechnic Institute* and *McMaster University*.

A systematic and short method for computing the expected values of mean squares has been developed and applied to a two-way crossed classification model with proportional frequencies. The model in which the number of observations is equal is obtained as a special case. The variance components are then derived for a two-way nested classification model, also with proportional frequencies. In both cases Type I, II, III, and mixed models have been considered.

3. LINEAR PROGRAMMING.

R. J. Freund; *Virginia Polytechnic Institute*.

Linear programming is essentially a mathematical device viz. to maximize a linear function of non-negative elements, $\Sigma s_i x_i$ where $x_i \geq 0$ subject to some linear inequalities, $\Sigma t_{ij} x_i \leq 8\ v_i$.

Some applications for this device are quite obvious, while others do not, at first glance, appear as linear programming problems. Three types of problems are discussed: 1. An analysis of a productive firm; 2. A mixing problem; and 3. A transportation problem.

4. USE OF ELECTRONIC COMPUTERS FOR SAMPLING EXPERIMENTS.

Daniel Teichroew; *National Cash Register Company*.

This paper discusses some of the problems encountered in using high speed electronic computers for random sampling experiments. The major difficulties are concerned with the generation of uniform random variates within the machine and the transforming of these variates to ones having the desired distribution. Some of the sampling experiments performed on the National Bureau of Standards Western Automatic Computer (SWAC) are described. These experiments were performed to compute power functions of various non-parametric tests and misclassification probabilities for linear discriminant functions.

5. ECONOMIC PROBLEMS ARE SUBJECT TO STATISTICAL ANALYSIS.

D. P. Morton; *Virginia Polytechnic Institute*.

Those who are responsible for making decisions regarding capital

expenditures for industrial capacity must know what the probabilities are for continued expansion of the United States economy and for the relative prospects of the industry they represent.

Statistical analysis, particularly with time series, can be material aid in reaching sound decisions.

One problem is quite pertinent today in view of the long post-war period of expansion, and the memory of the great depression following the first World War. That is, "When may conditions be ripe for another depression?"

This problem is studied by a time series analysis of industrial production since the Civil War. The conclusion is reached that a high level of industrial activity should be expected through 1962.

6. USE OF PRINCIPAL COMPONENTS IN ECONOMIC PROBLEMS.

Edwards Ned Fiske; *Virginia Polytechnic Institute.*

The co-variability of the x's (the independent variables) often hinders correct interpretation of the coefficients in a regression model ($y = b_1 x_1 + b_2 x_2 + \ldots + b_n x_n$).
Therefore, it is natural to ask whether there exist other independent variables, possibly fewer in number than the original x's, which determine the values the y's will take. One such fundamental set of independent variables, say $z_1 z_2 \ldots, z_p$, is called a set of principal components.

Principal components analysis consists of a linear transformation of the x's to the new variables: $Z(nxp) = X(nxp)\ P(pxp)$. The columns of the P matrix (the transformation matrix) are orthogonal and are the direction cosines of the principal components. They are obtained by an iterative procedure. The orthogonality of the z's assures their independence, and the iterative procedure causes the z's to account for as much as possible of the variation in the x's in descending order.

The transformation matrix P can be used to obtain the regression of the z's on the dependent variable y. This regression will reduce the total sum of squares by exactly the same amount as the regression on the original variables, the x's. However, due to the orthogonality of the z's, the regression coefficients are capable of interpretation although there is no guarantee that the principal components themselves are capable of interpretation. Thus, although one may be no better off with a principal components regression than with the usual regression, if the components are meaningful, one has certainly gained by the procedure.

7. SOME DISTRIBUTION THEORY CONNECTED WITH GAUSSIAN PROCESSES.

I. Miller and J. E. Freund; *Virginia Polytechnic Institute.*

A variety of physical and economic problems give rise to observations

which can be regarded as functions of time. The familiar random walk problem is an example in which the time function is discrete, there being a complete distribution of states in which the particle can find itself at any given "step". The classical Brownian motion problem of Physics is generally connected with the random walk scheme. On the other hand, data arising from vibration records mounted in aircraft, in the form of economic time series, etc., are examples of continuous time-dependent stochastic processes. The term "random process" is used throughout the theory of probability to cover sequences of random variables. The synonymous term "stochastic process" is ordinarily used to indicate the introduction of a continuous time parameter. Strictly speaking, a sequence of random variables constitutes a random process only when every finite sub-sequence possesses a joint probability distribution. It is the purpose of this paper to study some of the properties of Gaussian stochastic processes, that is, stochastic process which have the property that every finite sub-sequence has the multivariate normal distribution.

8. THE DISTRIBUTION OF COLUMN TOTALS IN SOCIOMETRIC MATRICES.

Paul D. Minton; *Virginia Polytechnic Institute.*

Consider an n-by-n sociometric matrix, i. e., one whose elements are zeroes and ones with no entries in the main diagonal. Such a matrix may be used to represent the result of a sociometric survey by using the rows and columns to correspond to a people in a closed group naming each other as to popularity, leadership, desired work partners, etc. A "one" in the *ith* row and *jth* column indicates that person i named person j.

If the rows and columns are totalled, then the row totals indicate the number of persons each person names and the column totals indicate that number of times each person is named by others. The column total is then of interest as the number of "votes" received by each person with regard to popularity, leadership, etc.

Under the assumptions that each person names k others and that the entries occur at random, the joint distribution of two column totals (pre-selected) is obtained.

9. ESTIMATION OF INDIVIDUAL VARIATIONS IN AN UNREPLICATED TWO-WAY CLASSIFICATION.

Thomas S. Russell and Ralph A. Bradley; *Virginia Polytechnic Institute.*

Consider a two-way classification, the usual model

$x_{ij} = \mu_i + \beta_j + \xi_{ij}$, $i = 1, \ldots, n$, $j = 1, \ldots, r$ (for example,

r chemists and n batches or r judges and n items) and the usual assumptions except let Var $(\xi_{ij}) = \sigma_j^2$. It was assumed that an estimator Q_j of σ_j^2 should be a quadratic form in the (r-1) (n-1) linear contrasts usually ascribed to error. Reasonable requirements on such a quadratic form led to the estimator in

$Q_j = [r(r-1)E_j - E] / [(n-1)(r-1)(r-2)]$ where $E_j = \sum_{i=1}^{n} (x_{ij} - x_{i.} - x_{.j} + x_{..})^2$

and $E = \sum_{j=1}^{r} E_j$,

the usual error sum of squares. Q_j is the estimator previously suggested by Ehrenberg (Biometrika, Vol 37 (1950), pp. 347-357). Q_j has been shown to be the maximum likelihood estimator of σ_j^2 only when r=3. When $\sigma_j^2 = \sigma^2$ for all j, the distribution of Q_j/σ^2 has been shown to be that of $r\chi^2_{n-1} / (n-1)(r-1) - \chi^2_{(n-1)(r-2)} / (n-1)(r-1)(r-2)$, the two χ^2's being independent. Q_j/E has been shown to be a monotone function of an F with (n-1) (r-1) and (n-1) degrees of freedom formed from those χ^2's. The joint distribution of the Q's has been considered and further research on various aspects of the problem is underway. (Work supported by A.R.S., U.S.D.A. and Q.M.R. and D., U.S. Army.)

10. RESTRICTED OCCUPANCY THEORY.

John E. Freund; *Virginia Polytechnic Institute.*

If a number of persons rate a product on a subjective scale, says, 1, 2, 3, . . . , or m, it is not only important to know the average rating but it is also important to know the consistency of the ratings. In order to test whether for a given average rating the scores assigned by different judges are consistent, it is felt that an appropriate mathematical

model is provided by that of restricted occupancy theory. The resulting distribution theory is discussed, and suitable tables for tests of significance are given for special values of m.

11. THE CORRELATION BETWEEN VARIATE-VALUES AND NORMAL SCORES FOR RANKS (A PRELIMINARY REPORT).

R. A. Bradley and H. A. Still; *Virginia Polytechnic Institute.*

It is common practice in taste testing to replace ranks (when ranks are used) with normal scores from Table XX of the *Statistical Table for Biological, Agricultural and Medical Research* by Fisher and Yates, and then use methods of analysis of variance. Alan Stuart, British Journal of Statistical Psychology, Vol. 7, Part I, 1954, obtained theoretically the correlation between variate values and corresponding ranks. Using a similar approach we have developed some analogous results for the correlation between variate values and normal scores for ranks. These correlations are evaluated in a number of special cases, notably for the normal distribution and the uniform distribution. Use of these correlations may be possible in studies of relative efficiencies of test procedures and this and further extensions are under investigation.

12. VARIATIONS FLOW ANALYSIS.

N. L. Enrick, *Institute of Textile Technology.*

Variations Flow Analysis is a new statistical tool for tracing the flow of variations in multi-machine and multi-process manufacturing. Thus, sources of inconsistently high variation are readily isolated. Such variations may exist within or between heads on multi-head machines, between machines, or between processing stages. In textile processing, where "doublings" and drafts take place, and in chemical processing, where mixings and dilutions occur, statistical allowances must be made for the transfer of variations from process to process.

Simplification is accomplished by using average ranges in place of mean-squares, with specially computed modified F-Tables for significance testing. The loss in statistical efficiency is compensated by increased testing. Experience with this method in over fifty plants has shown that non-mathematical personnel in the plant can better appreciate the simplified method. As a result, they are in a better position to co-operate in the translation of statistical findings into actual processing improvements.

13. STATISTICAL PROPERTIES OF INVERSE GAUSSIAN DISTRIBUTIONS.

M. C. K. Tweedie; *Virginia Polytechnic Institute.*

The probability density function of the variate x is

$$f(x;\ \mu,\ \lambda) = \exp\{-\lambda(x-\mu)^2/2\mu^2 x\}\sqrt{\lambda/2\pi x^3}$$

with parameters μ and λ where x, μ and λ are all positive. The expectation of x is μ, while λ is a measure of relative precision, being K_1^3/K_2. The shape of the distribution depends on the ratio $\phi = \lambda/\mu$. It is postively skew and leptokurtic for finite ϕ, but is normal in the limit as ϕ increases indefinitely. The chief result is that the ML estimators of μ and λ have stochastically independent distributions, and are of a nature which permits of the construction of an analogue of the analysis of variance for nested classifications. The ML estimator of μ is the sample arithmetic mean, and for a fixed sample size n its distribution is of the same family as x, with the same μ but with λ replaced by λn. The distribution of the ML estimator of the reciprocal of λ is of the chi-square type, and therefore the usual tables of χ^2 and F can be used for significance tests, etc. The probability distribution of 1/X and the estimation of certain functions of the parameters in heterogenous data, are also considered. The regression mean of unbiased estimators of the cumulants, an the sample mean, is found. With

$\bar{x} = \Sigma x/n$ and $s^2 = \Sigma(x-\bar{x})^2/(n-1)$,

the expectation and asymptotic mean square error of $s^2/\bar{x}^3$, as an estimator of $1/\lambda$ are found, from which its asymptotic efficiency is $\phi/(\phi+3)$. The statistic $\chi_s^2 = (n-1)s^2/E(s^2 \mid \bar{x};\ \lambda, n)$ is also considered.

14. THE POWER OF MULTIPLE RANGE TESTS.

R. Lowell Wine; *Virginia Polytechnic Institute.*

In place of the usual power function used to compare two tests when testing the differences in a pair of means, a set of n(n-1) power functions is introduced for testing differences between pairs from a set of n means. Before power expressions are formulated for a class of multiple range tests, the regions of integration are carefuly described.

Methods are presented for calculating these expressions, and tables giving power for the three or four mean cases are included. A method is introduced for comparing two tests using their corresponding n(n-1) power functions.

15. FACTORIALS IN NEAR BALANCED INCOMPLETE BLOCK DESIGNS FOR k(k-q) TREATMENTS (Preliminary Report).

C. Y. Kramer and R. A. Bradley; *Virginia Polytechnic Institute.*

In this paper the adjusted treatment sum of squares in near balanced incomplete block designs with k(k-q) treatment is given as a function of the estimated treatment effects. This new form is valid both when the blocks are grouped into replications in the form of the near balanced rectangular lattice or the latinized rectangular lattice and when no grouping into replications is effected. By imposing factorial arrangements of treatments on these designs and by using orthogonal contrasts, the sums of squares for the factorial effects with one degree of freedom are found as functions of the estimated treatment effects. A complete analysis of variance for the factorials set in these designs is developed. If the factorial treatments are assigned to the blocks in a special manner, the sums of squares for a (k-q)-level factor are obtained free of block adjustment. This work is preliminary to a more intensive study of the analysis of factorial arrangements of treatments introduced into incomplete block designs of various classes. That this can be done for any balanced incomplete block design seems to be well known but not discussed in statistical literature.

BUSINESS MEETING

The following new officers were elected: *Chairman,* J. E. Freund; *Vice Chairman,* N. L. Enrick; *Secretary,* Clyde Y. Kramer; and *Section Editor,* P. N. Somerville.

LIST OF MEMBERS
1955-1956

Note: Following are the types of membership in the Academy.

•••*Patrons,* who contribute one thousand dollars or more to the Academy.

••*Life Members,* who contribute one hundred dollars or more to the Academy.

••*Honorary Life Members* (Elected by Council).

•*Sustaining Members,* who pay annual dues of ten dollars.

–*Contributing Members,* who pay annual dues of ten dollars.

Regular Members, who pay annual dues of three dollars.

Student Members, who pay annual dues of two dollars. (restricted to college students only).

Note: Number following name designates section, or sections, to which member belongs; "C" following name indicates "Student Member"; "B" following name indicates "Business Member."

1. Agricultural Sciences
2. Astronomy, Mathematics, and Physics
3. Bacteriology
4. Biology
5. Chemistry
6. Education
7. Engineering
8. Geology
9. Medical Sciences
10. Psychology
11. Science Teachers
12. Statistics

Please notify Foley F. Smith, P. O. Box 1420, Richmond, of any errors you may find in this list.

Abbott, Betty J., 4 ..... 2730 Broad St., N.W., Roanoke 12

Abbott, Dr. Lynn D., Jr., 9, 5 ..... Medical College of Virginia, Richmond

Abbott, S. L., Jr. 10, 6 ..... 11 Broadway, Plymouth, New Hampshire

••Addison, W. Meade ..... 2000 Monument Ave., Richmond

Akerman, C. J., 5 ..... Dept. of Biochemistry, V.P.I., Blacksburg

••Albemarle Paper Manufacturing Co. ..... Richmond

–Alden, Prof. Harold L., 2 .... Box 3445, Univ. Station, Charlottesville

Allan, Dr. D. Maurice 10 ..... Hampden-Sydney

Allen, Carl W. 1 ..... Box 246, Blacksburg

Allen, Dr. J. Frances 4 ..... Univ. of Maryland, Dept. of Zoology, College Park, Md.

Alley, Prof. R. E., Jr. 2, 7 .... Physics Dept., Washington & Lee Univ., Lexington

Allen, Dr. Rhesa M., Jr. 8 ..... French Coal Co., Bluefield, W. Va.
Allied Chemical & Dye Corp. B ..... Nitrogen Div., Hopewell
Alrich, Dr. E. Meredith, 9 ..... Univ. of Va. Hospital, Charlottesville
Alston, R. E. 4 .... Dept. of Botany, Univ. of Texas, Austin 12, Texas
Alvey, Dr. Edward, Jr. 6 ..... Mary Washington College, Fredericksburg
American Tobacco Co. B ..... Research Lab., Petersburg Pike, Richmond
Amore, Dr. Thomas 5 ..... Cardinal Products Co., Box 1611, Durham, N. C.
Amos, John W. 4 ..... V.P.I., Blacksburg
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